UK Health Security Agency

Safer radiotherapy

Biennial radiotherapy event data analysis and learning report

Report number 9: full radiotherapy event data analysis, January 2024 to December 2025

Contents

Executive summary

Radiotherapy in the UK is delivered safely and accurately to tens of thousands of patients each day. However, event learning systems are essential to identify risks and improve patient safety. All NHS radiotherapy providers, as well as the independent sector, contribute to the UK Health Security Agency (UKHSA) national radiotherapy event learning system for incidents and good catches.

This ninth biennial report analyses 25,831 reported radiotherapy events (RTEs) during 2024 to 2025, compared with 22,113 in 2022 to 2023, alongside longer-term trend data from 2021 to 2025. Estimated reporting rates increased to 6.4 events per 1,000 attendances, up from 5.7 in 2022-2023. While reporting volumes increased by 16.8%, this may reflect a combination of improved reporting culture, rising service activity, and ongoing workforce pressures. The vast majority of events (97.0%) were classified as low severity or good catches, resulting in minimal or no impact on patient care.

The proportion of voluntarily reported RTEs that met the reporting criteria under the Ionising Radiation (Medical Exposure) regulations (1, 2) increased from 1.6% to 2.3%, with an estimated reporting rate of 1.3 per 1,000 prescriptions compared with 0.9 in 2022 to 2023. Most reportable events arose during planning or verification imaging rather than treatment delivery. The recent reduction in the proportion of reportable events associated with treatment delivery represents a positive trend and may reflect improvements in patient safety within the treatment pathway.

Key trends include:

- growth in reportable incidents, particularly related to repeated imaging due to equipment faults
- on-set imaging processes remain the most common source of events across multiple severity levels
- increasing contribution of equipment and IT failures (10.3% in 2021 to 17.0% in 2025)

A strong safety culture, open reporting, and shared learning remain critical. Continued engagement with national event learning systems supports benchmarking and ongoing improvements in patient safety

Local provider recommendations:

1. All NHS UK providers should continue to use the national taxonomies, adopting the refinements found within the recently published Safer radiotherapy National patient safety radiotherapy event taxonomy, to fully code all levels of RTE for local analysis, learning and practice.

2. The wider context of the system where the event occurred should be considered when reviewing RTE to ensure all contributory factors are identified and appropriately addressed.
3. Local employers should provide adequate resourcing to support the development and maintenance of effective patient safety systems and processes. Likewise, they should encourage national reporting of all classification levels of severity of RTE on a monthly basis to ensure timeliness of shared learning.
4. Equipment-related incidents should be reported to the relevant regulator, manufacturer and UKHSA. If equipment faults persist a risk assessment should be undertaken for the ongoing use of the device.
5. Local and regional radiotherapy event learning should be benchmarked against national data to identify trends and opportunities for improvement. Findings from event analysis should be used to inform prospective risk assessments, support the evaluation of risks associated with accidental and unintended exposures, and guide service development, quality improvement initiatives, education and training programmes, and business planning (3).

National recommendations:

1. Learning from RTE should be used by the Patient Safety in Radiotherapy Steering Group (PSRT) and individual RT providers as part of a risk-based approach to allocating resources for improving patient safety in RT and to inform audit and research.
2. PSRT should engage the relevant agencies and vendors in developments to monitor and reduce the rate of RTE related to imaging equipment failure.
3. Providers utilising molecular radiotherapy (MRT) or diagnostic MRI facilities are encouraged to use the National taxonomy for incident learning in clinical imaging, magnetic resonance imaging and nuclear medicine guidance and report within the National incident learning system in clinical imaging, MRI and nuclear medicine.
4. The PSRT will continue to develop guidance for UK RT providers to support the advancement of safer RT through the adoption of contemporary thinking in the field.
5. The PSRT should continue to develop its analysis of the newly refined Safety Barriers taxonomy, using insights gained to inform improvement initiatives and strengthen safety practice.

References

1. 'The Ionising Radiation (Medical Exposure) Regulations 2017' The Stationery Office, London, SI 2017/1322
2. 'The Ionising Radiation (Medical Exposure) Regulations (Northern Ireland) 2018' The Stationery Office, London, SR 2018/17
3. UKHSA(2025). Advancing Safer Radiotherapy (ASR)

Introduction

Within the dynamic, complex radiotherapy environment, patient safety, defined as the avoidance of excessive morbidity or sub-optimal tumour control (1), cannot be assumed due to the significant consequences of failure. Safe practice relies on many factors, with a strong safety culture being essential to minimise both the risk and impact of errors. In radiotherapy, this means proactively identifying, evaluating, and reducing risks, while also learning from successes to improve practice. Delivering the safest treatments requires continual review and refinement of clinical workflows. As new technologies and techniques are introduced, providers must ensure robust processes for monitoring and evaluating safety, within an environment where staff feel supported to report events without fear of blame.

Event learning systems are a widely accepted safety tool in radiotherapy, supported by professional bodies and regulators (2). However, whilst the collection of all types of radiotherapy events is essential, the effective analysis of events is a vital aspect of patient safety, allowing providers to identify weaknesses in operational systems and inform the direction of future refinements and improvements. Evidence of correlation between initiation of local event learning systems and subsequent reduction in serious events has been reported by many groups (3 to 7) indicating their efficacy.

When local event learning systems contribute to national systems, broader trends often not visible at individual provider level can be identified earlier. National analysis allows benchmarking and supports the setting of realistic, evidence based patient safety goals.

This report presents analysis of RTE reported over a 2-year period to the UK national radiotherapy event learning system managed by the UK Health Security Agency (UKHSA). RTE are defined either as unintended divergences from planned treatment or processes defined as correct by local protocol, good catches detected prior to radiation delivery, or other non-conformances not directly affecting radiotherapy delivery.

Background

In this report, radiotherapy (RT) is defined as the use of high-energy ionising radiation in the treatment of disease, including external beam, superficial, orthovoltage and brachytherapy. Events from diagnostic imaging, MRI outside the radiotherapy department and nuclear medicine (including molecular radiotherapy) are reported separately within the National incident learning system in clinical imaging, MRI and nuclear medicine.

This ninth report presents analysis of anonymised RTE data voluntarily reported between January 2024 and December 2025, with trend analysis from January 2021 to December 2025. This analysis, conducted by the UKHSA using data from NHS and independent providers, and

enforcing authorities under Ionising Radiation (Medical Exposure) Regulations (IR(ME)R) (8, 9), has been reviewed by the Patient Safety in Radiotherapy Steering Group (PSRT).

The PSRT comprising of representatives from the Institute of Physics and Engineering in Medicine (IPEM), the Royal College of Radiologists (RCR), Society of Radiographers (SoR), a lay representative, and UKHSA leads collaborative work to improve radiotherapy patient safety. It recommends using this report and UKHSA's triannual analyses (10), to support local learning and comparison of locally identified trends against the national picture.

Obtaining the data

UKHSA has a data sharing agreement with NHS England and under this agreement RTE data is extracted and shared with UKHSA for analysis. Over the past 2-year period data was obtained from either the National Reporting and Learning System (NRLS) or Learn from Patient Safety Events (LFPSE) patient safety reporting platforms in England. In July 2024 NRLS was officially decommissioned and withdrawn from use, and LFPSE replaced NRLS entirely.

Welsh NHS providers report to the Once for Wales Concerns Management System (OfWCMS), which shares RTE data for analysis. RTE data is shared directly by providers in Northern Ireland, Scotland and from the independent sector.

In addition, anonymised synopses of closed reportable radiation incidents (Level 1) are shared by the UK IR(ME)R (8, 9) relevant enforcing authorities with UKHSA for inclusion in the analysis. This data is analysed separately from the voluntary data to reduce replication of Level 1 reports within the data. As IR(ME)R applies to both NHS and independent RT providers, this data covers both sectors. The relevant enforcing authorities will be referred to as inspectorates hereafter.

Data

The data presented in this report is anonymised and received as part of a voluntary reporting scheme. As with all voluntary event learning systems, reporting levels can differ between providers. The figures represent only those events submitted to the national system and do not reflect the true number of occurrences. Additionally, as the data does not adjust for differences in provider size, capacity, or service complexity, it should be interpreted with caution.

Data for the reporting period January 2024 to December 2025 forms the focus for the analysis. Where possible, comparisons are drawn against the previous 2-year reporting period (January 2022 to December 2023) and data for annual reporting periods going back over 5 years.

Importantly, the current 2-year reporting period straddled the publication in May 2025 of Advancing Safer Radiotherapy and the National patient safety radiotherapy event taxonomy, the latter of which refined and superseded the previously published taxonomies.

The National patient safety radiotherapy event taxonomy introduced, or updated terminology, including:

- update of radiotherapy error to radiotherapy event
- update of near miss to good catch
- introduction of a modality taxonomy to describe the radiotherapy type or technique
- updates to the descriptions of 21 pathway subcodes to reduce ambiguity
- introduction of 11 new pathway subcodes
- merging of a number of pathway subcodes to reduce duplication
- expansion of end of process check codes to allow for additional granularity

Data quality

All providers are asked to apply the full coding taxonomy to each RTE report. Since the adoption of the National patient safety radiotherapy event taxonomy this includes; trigger code (TSRT9), classification level, pathway coding, method of detection (MD), contributory factors (CF) and modality (D) to facilitate both local and national analysis.

The format of coding for submission is:
TSRT9/ Level 4/ 13c/ 13l/ MD13nn/ CF5a/ CF2b/ D04.

On receipt, UKHSA staff with clinical radiotherapy expertise conducted consistency checking of local coding. All RTE classified Levels 1 to 4 were reviewed, while 10% of Level 5 were audited as part of the data quality assurance process completed prior to analysis.

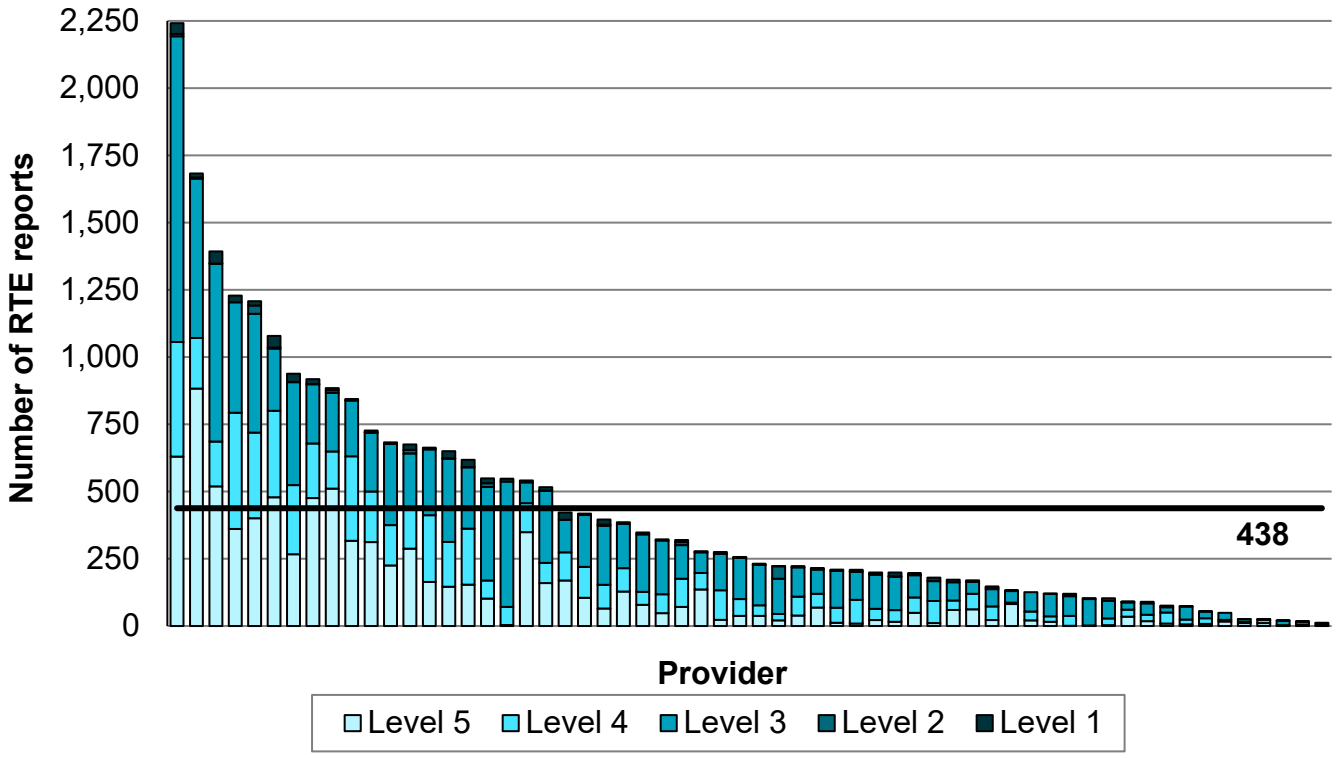
During this review period 26,182 event reports were received, reflecting a 17.4% increase in the total volume of reports compared to the previous 2-year period (n=22,303). Of the 26,182 reports received, 63.6% (n=16,657) were classified and coded by local RT providers. This is a small increase in proportion from the previous 2-year period (58.4%, n=13,021). Of those complete reports in this review period 18.8% (n=3,134) were amended, to ensure consistency of application of taxonomies, during the quality assurance process at UKHSA.

The analysis excluded 280 reports (1.1%). These were largely slips, trips or falls that occurred within the RT setting. A further 71 reports failed to provide any RTE taxonomy and contained insufficient information for UKHSA to assign coding and were excluded from the analysis. These deductions left a total of 25,831 RTE reports (98.7%) included in the analysis.

Number of reports per provider

For this 2-year period, reports were received from all NHS RT providers. In addition, reports were received from the independent sector. Some 943 anonymised reports received did not indicate the RT provider, these have been included in Figure 1 as a single provider, although the mean reporting is calculated using the 59 contributing radiotherapy providers.

Figure 1. Number of RTE reported by provider (n=25,831)



Reporting volumes varied widely between providers (12 to 2,242 reports). The average increased by 20.7% from 363 per provider during the previous 2-year period, to 438 for the current period, although two-thirds of providers reported below the average. These figures are not adjusted for differences in population and activity across sites.

Results

A total of 25,831 classified RTE reports were submitted to the voluntary national event learning system between January 2024 and December 2025, with an average 1,076 reports received per month. This reflects an increase of 16.8% in comparison to the previous 2-year period, whereby 22,113 RTE reports were received, with a monthly average of 921 reports. The 25,831 RTE reports were categorised so main themes could be derived. The data analysis has been presented using graphs, bar charts and pie charts to facilitate local replication of the analysis using local data to enable data comparison.

Between January 2021 and December 2025, UK RT providers submitted 57,488 RTE to the national event learning system. The annual breakdown of the number of reports submitted for last 5-year period can be seen in Table 1.

Table 1. Number of RTE reports submitted to the incident learning system by year

Year	2021	2022	2023	2024	2025
Number of reports	9,544	11,471	10,642	12,140	13,691

Linear regression analysis was performed on 5-year period to assess relationships between year and outcomes. Statistical significance was set at $p<0.05$; for example, the annual increase in the number of reports received by UKHSA over this period in Table 1 was statistically significant ($p=0.03$).

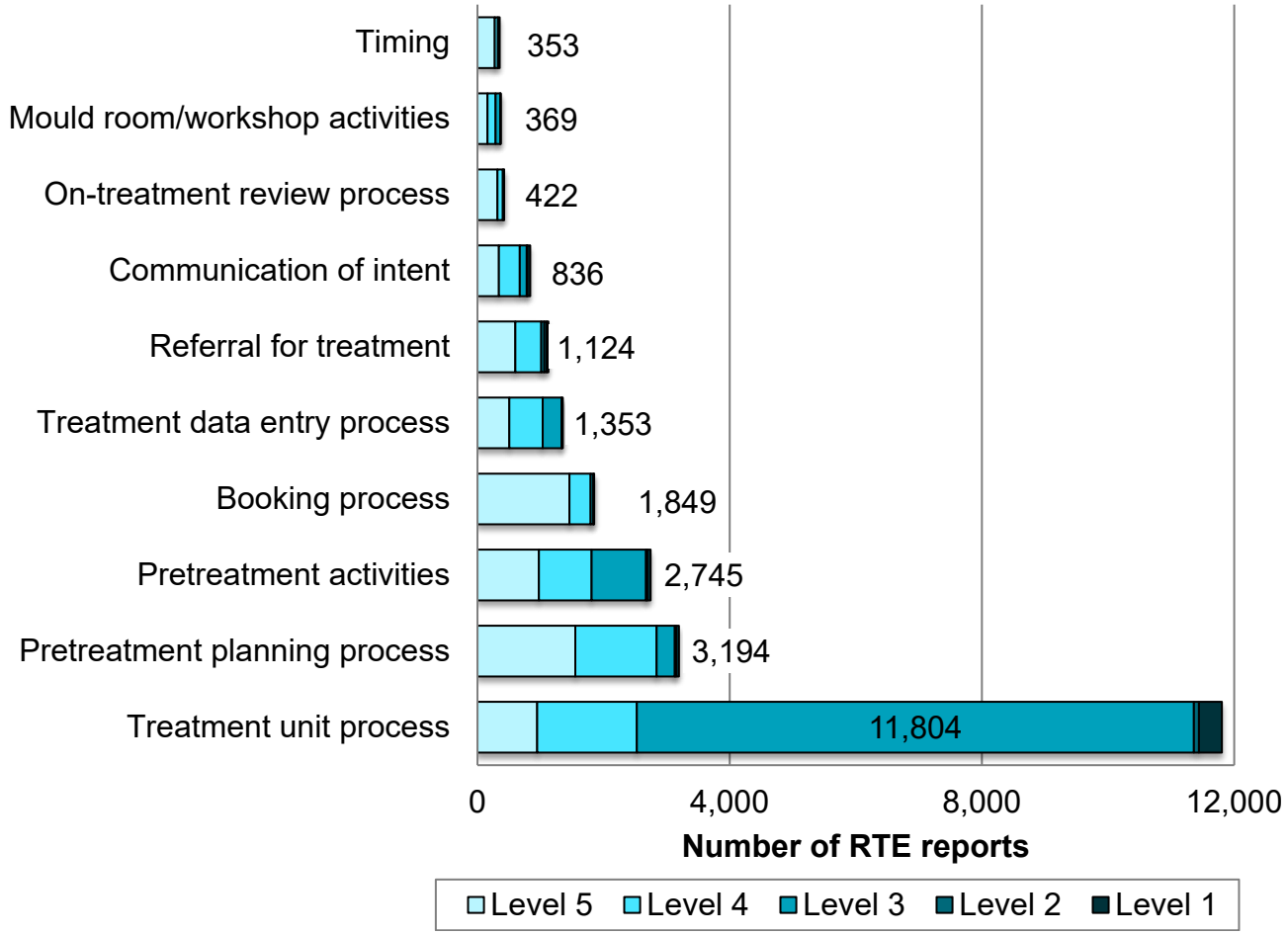
Breakdown of process codes

The dataset was categorised by process code according to *Development of Learning* (archived resource; no longer available) and *Towards Safer Radiotherapy* (11) methodology prior to May 2025, and using the refined National patient safety radiotherapy event taxonomy since May 2025, so the main themes could be derived.

The most frequently reported RTE process code was ‘treatment unit process’ (45.7%, n=11,804), reflecting a slight increase in proportion compared to the previous 2-year report (43.5%, n=9,614). The ‘treatment unit process’ represents the last opportunity to identify events prior to delivery. Due to the fractionated nature of radiotherapy this presents more frequent opportunities for events to occur compared to other steps in the pathway which may contribute to its high proportion of RTE reports.

The second most frequently reported RTE process code was ‘pretreatment planning process’ which comprised 12.4% (n=3,194) (Figure 2). The proportion of reports comprised of this code have decreased in comparison to the previous 2-year report (14.4%, n=3,193).

Figure 2. Breakdown of RTE process code by Level (n=24,049 out of 25,831 RTE)

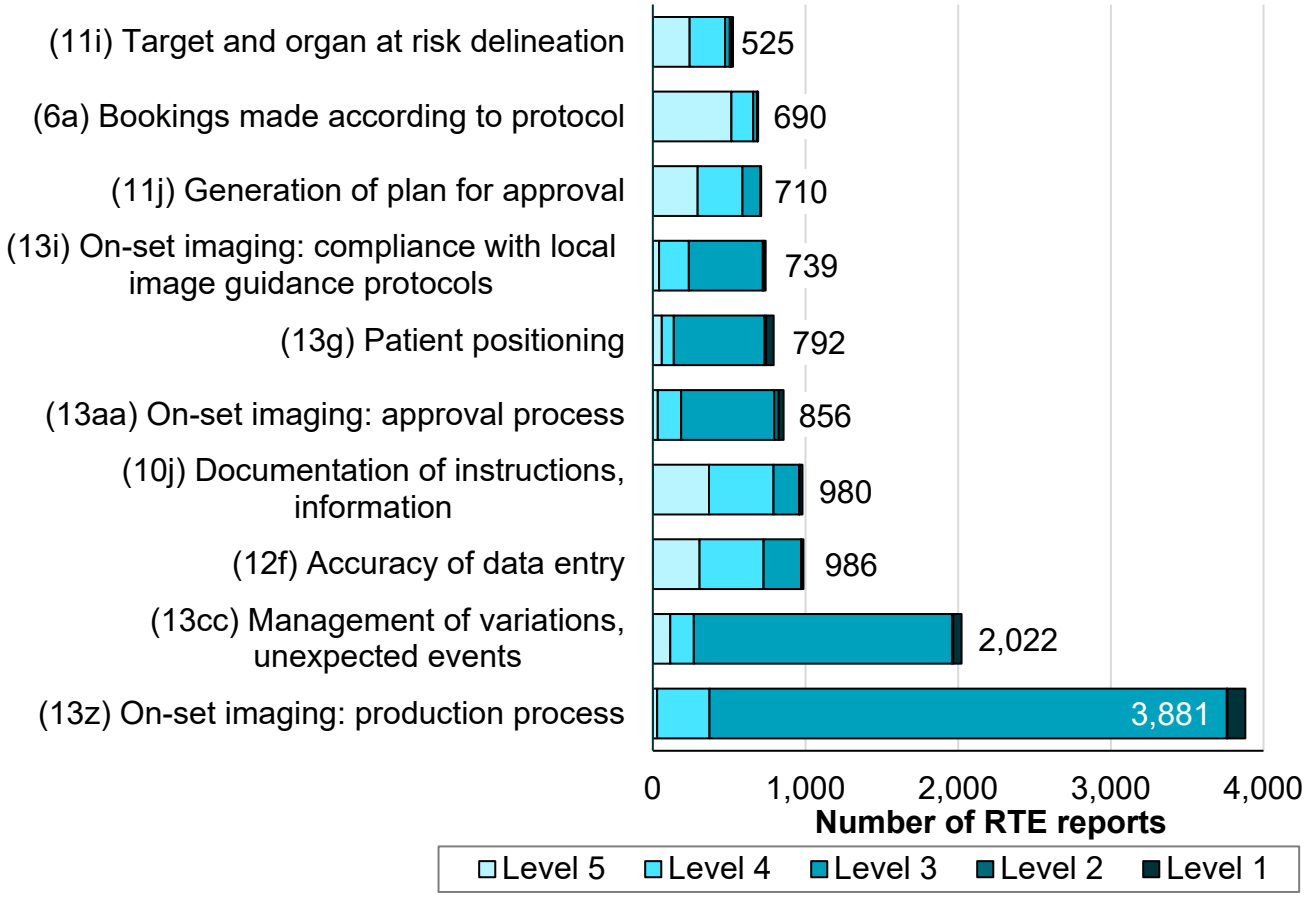


Breakdown of process subcodes

The most frequently reported primary process subcodes are presented in Figure 3. The most common RTE was ‘on-set imaging: production process’ (15.0%, n=3,881). ‘Management of variations, unexpected events’ was second (7.8%, n=2,022). Both of these were mainly linked to equipment or IT network failure (62.8%, n=2,439 and 83.7%, n=1,693 respectively).

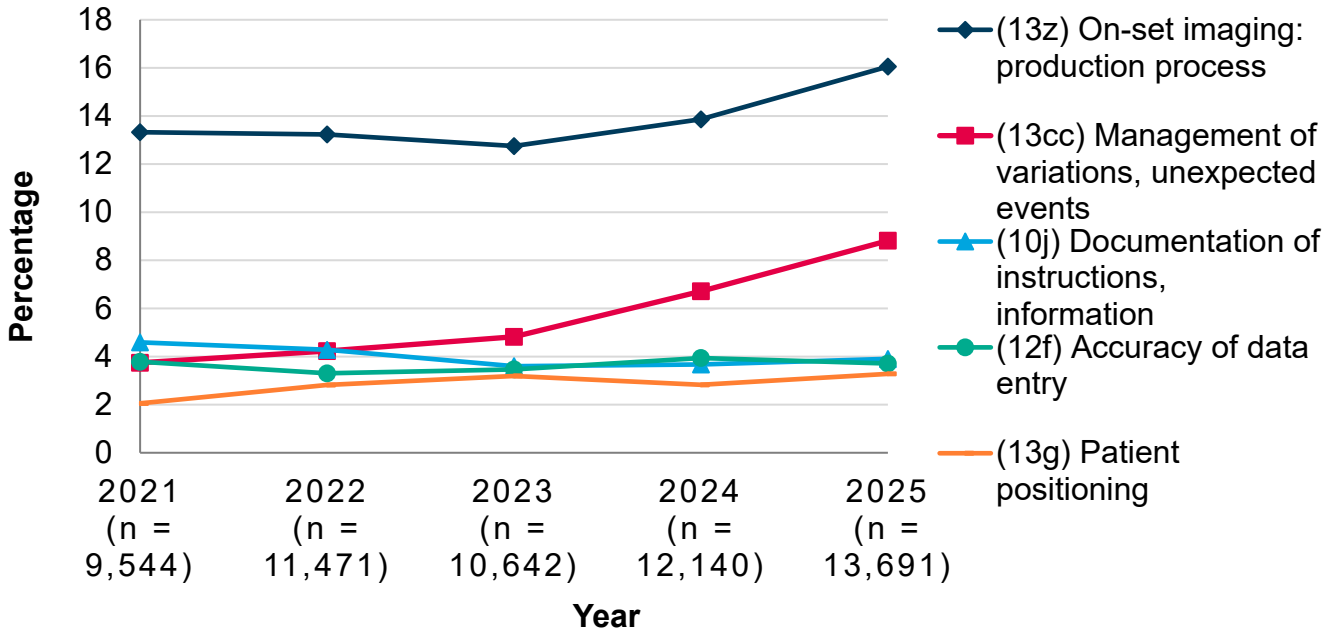
Overall, on-set imaging-related events accounted for nearly a quarter of all RTE reported (23.0%, n=5,930), consistent with the previous 2-year reporting period (22.6%).

Figure 3. Breakdown of most frequently reported RTE primary process subcodes by Level (n=12,181 out of 25,831 RTE)



The most frequently reported primary process subcodes over the past 5 years are shown in Figure 4. The ‘on-set imaging: production process’ subcode, after a slight decline between 2021 and 2023, has rebounded to 16.1% in 2025.

Figure 4. Trends of most frequently reported RTE by primary process subcode (January 2021 to December 2025)



The proportion of ‘management of variations, unexpected events’ has increased significantly from 3.7% in 2021 to 8.8% in 2025 (p=0.02). Other commonly reported pathway subcodes remain relatively stable, with no statistically significant trends observed.

Classification (Level) of RTE

Each of the 25,831 RTE reports were classified as ‘other non-conformance’ (Level 5), ‘good catch’ (Level 4), ‘Non-reportable (minor) radiation or MRI incident’ (Level 3), ‘non-reportable (moderate) radiation or MRI incident’ (Level 2) or ‘reportable radiation incident, or other notifiable event’ (Level 1). A breakdown of these can be seen in Figure 5. Of the RTE reports, 97.0% (n=25,054) were minor radiation, good catch or other non-conformances with little or no impact on patient outcome. Of the remaining 3.0% (n=777) reports, 2.3% (n=584) were reportable under IR(ME)R ([8, 9]) to the inspectorates.

Figure 5. Classification (Level) of RTE reports (n=25,831)

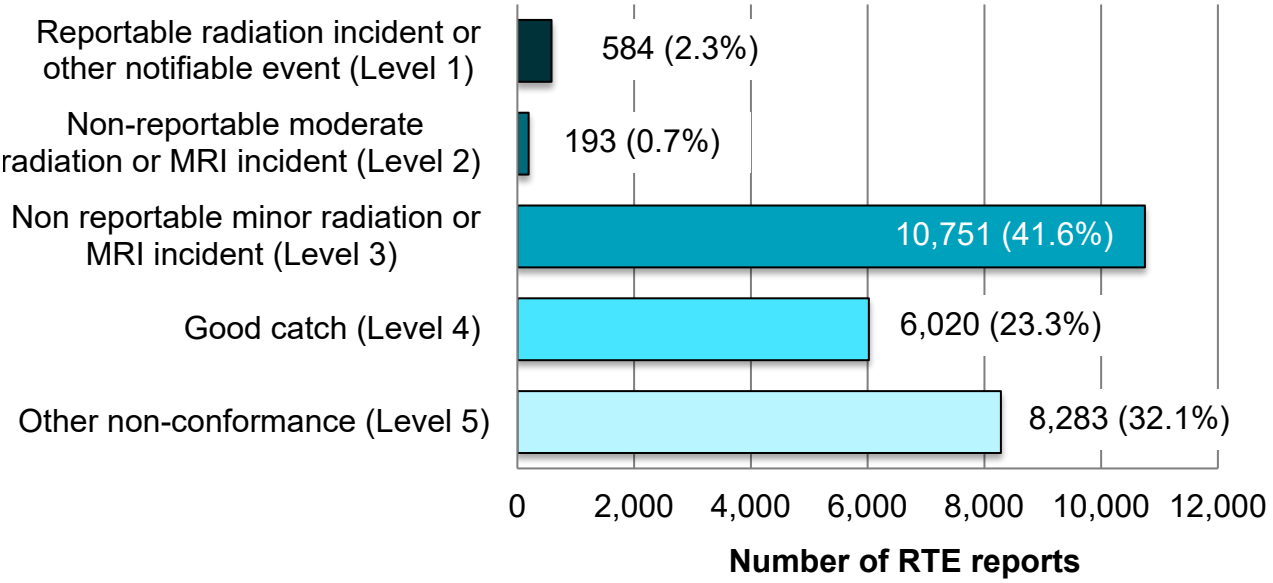


Table 2 shows the annual breakdown of the number of reports submitted for last 5-year period

Table 2. Classification (Level) as a percentage of RTE reports

Classification	2021	2022	2023	2024	2025
Other non-conformance (Level 5)	36.7	34.4	32.3	33.4	30.9
Good catch (Level 4)	26.3	26.1	25.7	23.7	22.9
Non-reportable (minor) radiation or MRI incident (Level 3)	35.2	37.5	39.1	40.0	43.1
Non-reportable (moderate) radiation or MRI incident (Level 2)	0.7	0.8	0.9	0.6	0.8
Reportable radiation incident or other notifiable event (Level 1)	1.1	1.2	2.0	2.3	2.3

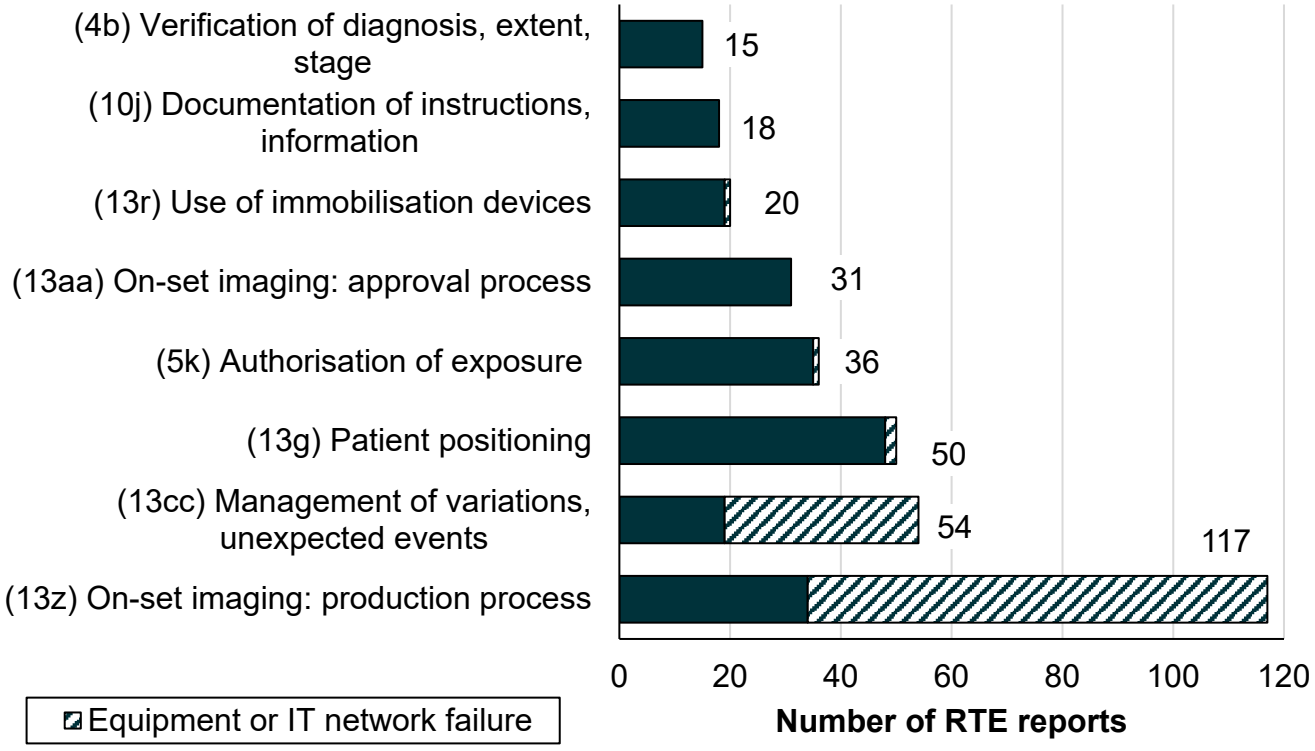
Reportable radiation incidents increased each year until 2024, the proportion stabilised in 2025. Non-reportable (minor) radiation or MRI incidents (Level 3) have steadily increased in proportion annually, a rise that is considered statistically significant (p=0.03). Good catch (Level 4) events have reduced in proportion annually, again a trend considered statistically significant (p=0.03).

Reportable radiation incident or other notifiable event (Level 1 RTE)

Reportable radiation incidents or other notifiable events, as defined in refined National patient safety radiotherapy event taxonomy, fall into the category of reportable under IR(ME)R (8, 9) to the inspectorates or other such authorities. Of the Level 1 RTE reported, the majority involved planning or on-set verification imaging, with only 27.0% (n=158) affecting the delivery of radiotherapy, commonly for only one fraction of a course of treatment. This meant that corrective action could be taken over the remaining treatment fractions, if considered necessary.

There were 584 Level 1 RTEs reported (Figure 6), an increase of 66.9% compared to the previous 2-year reporting period which recorded 350 Level 1 RTE. In addition, Level 1 RTEs were reported with 82 different process subcodes, compared to 66 different process subcodes for previous 2-year reporting period. Level 1 data was submitted by 58 out of 59 contributing providers.

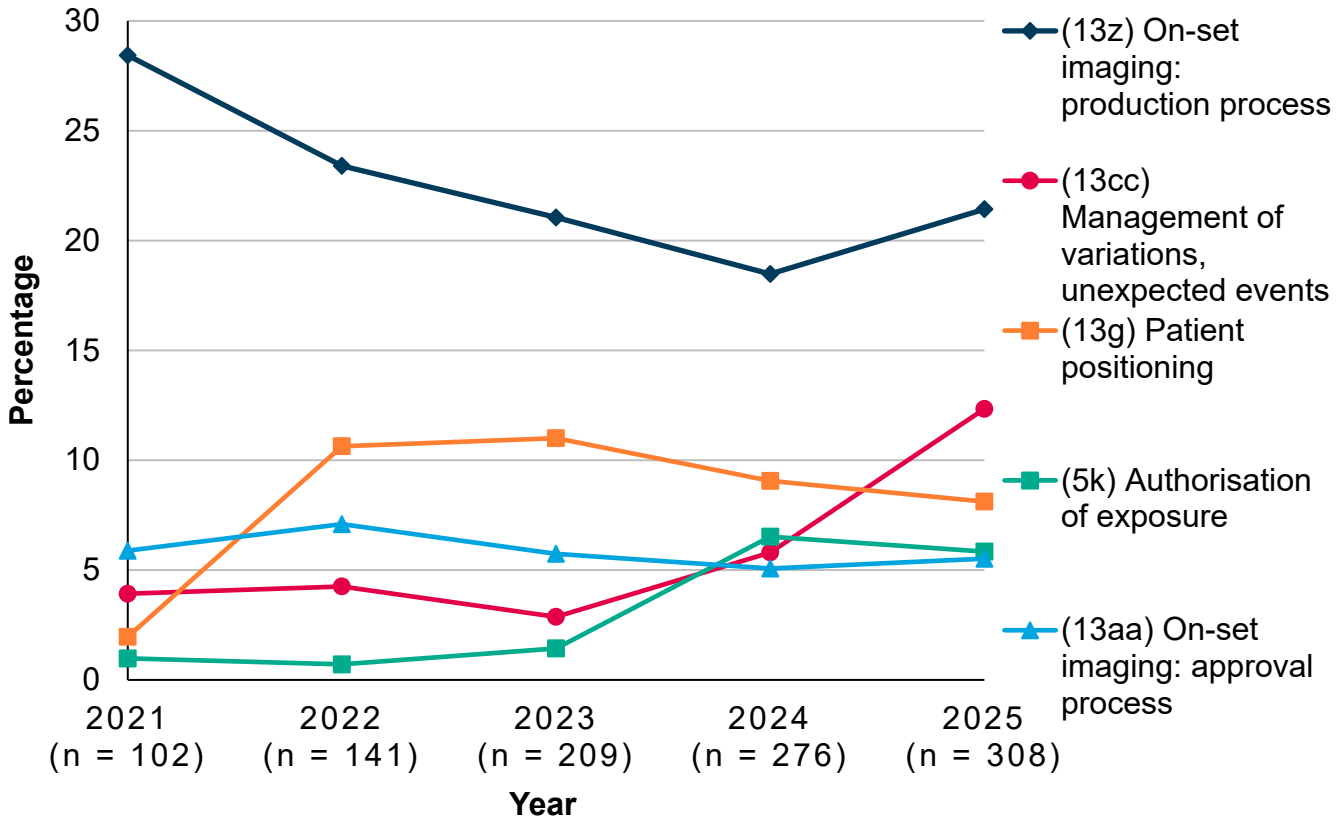
Figure 6. Breakdown of most frequently reported Level 1 RTE by process subcode (n=341 out of 584 RTE)



The most common level 1 RTE was ‘on-set imaging: production process’ (20.0%, n=117), mainly linked to equipment or IT network failures (70.9%, n=83). ‘Management of variations, unexpected events’ was the second (9.2%, n=54), also largely associated with equipment or IT network failure (64.8%, n=35). Examples of these types of RTE involve equipment faults leading to multiple repeat verification imaging.

Figure 7 shows changes in reported RTE as a proportion by year across the 5-year period from 2021 to 2025. After reaching a peak in 2021 (28.4%), 'on-set imaging: production process’ has reduced as a percentage to 21.4% in 2025. By contrast, ‘management of variation, unexpected events’ has increased its proportion from 3.9% in 2021 to 12.3% in 2025. However, in both situations the overall trend was not statistically significant.

Figure 7. Trends for most frequently reported Level 1 RTE by process subcode (January 2021 to December 2025)



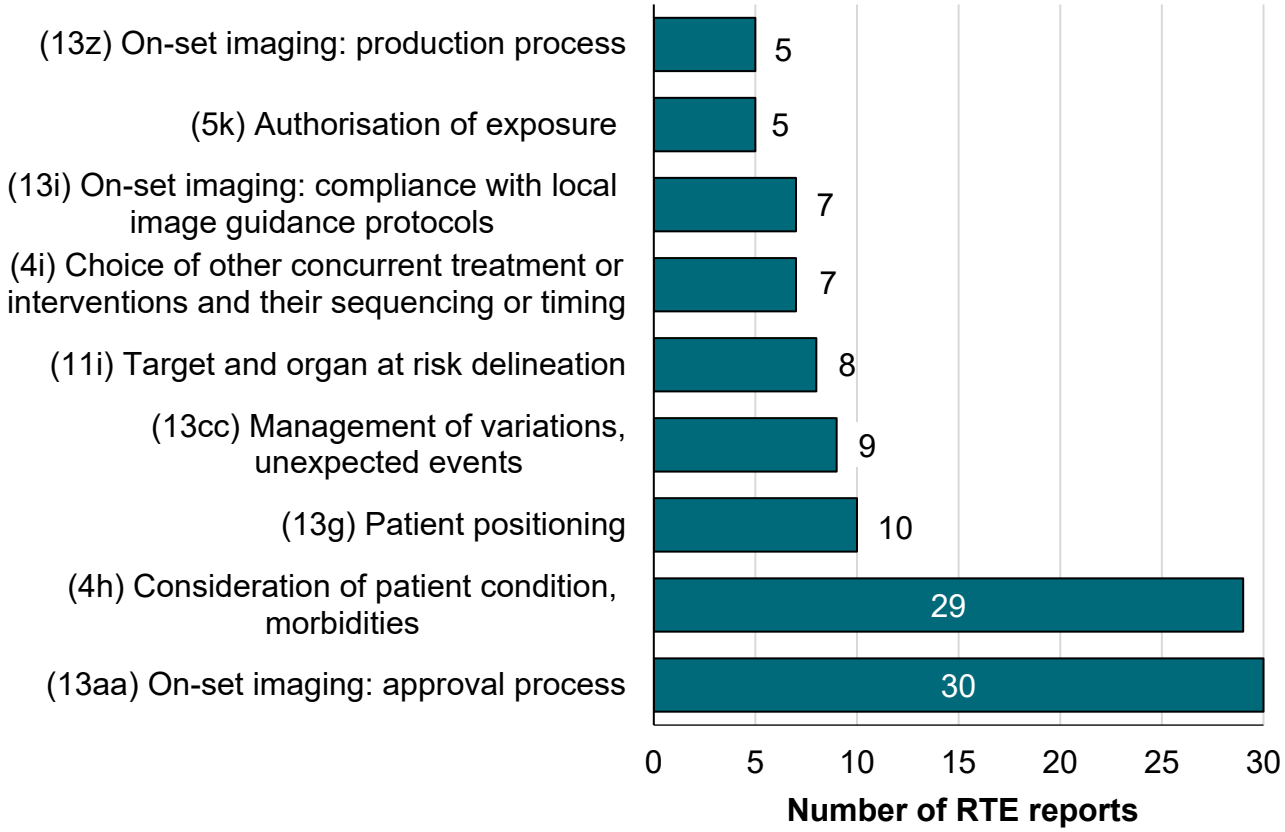
Other changes noted are an overall increase in proportion of ‘authorisation of exposure’ from 1.0% in 2021 to 5.8% in 2025, although no evidence of a statistically significant 5-year trend was observed.

Non-reportable (moderate) radiation incident or MRI incident (Level 2 RTE)

A non-reportable (moderate) radiation or MRI incident is defined as a radiation incident or MRI safety event that does not reach the threshold for notification in accordance with guidance but may be of potential significance.

There were 64 different subcodes associated with the 193 Level 2 reports shared. The most frequently reported Level 2 RTE can be seen in Figure 8. These were reported by 36 out of the 59 contributing providers.

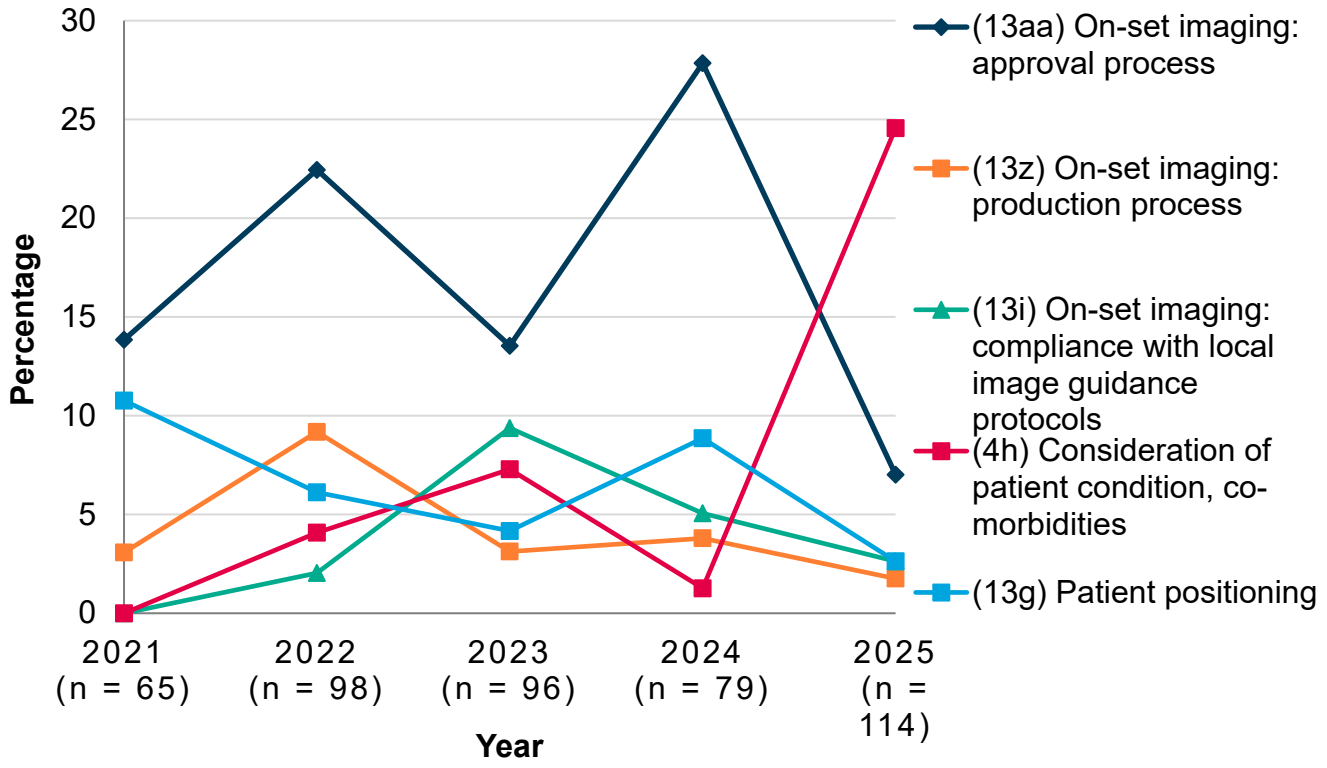
Figure 8. Breakdown of most frequently reported Level 2 RTE by process subcode (n=110 out of 193 RTE)



The most frequently reported Level 2 reports were associated with ‘on-set imaging: approval process’ at 15.5% (n=30). This was followed by ‘Consideration of patient condition/co-morbidities’ with 15.0% (n=29) of submitted Level 2 reports.

Figure 9 identifies trends by year across the preceding 5-year period. Notable year to year variation is identified for the level 2 classification. This may be due to the small number of reports recorded, coupled with local interpretation of the classification decision matrix (Appendix 1 - National patient safety radiotherapy event taxonomy).

Figure 9. Trends for most frequently reported Level 2 RTE by process subcode (January 2021 to December 2025)



Non-reportable (minor) radiation or MRI incident (Level 3 RTE)

A non-reportable (minor) radiation or MRI incident is defined as a radiation incident in the technical sense, or an MRI safety event, but one of no potential or actual significance. There were 159 different subcodes associated with 10,751 Level 3 reports, submitted by all providers. The most frequently reported RTE in this sub-group can be seen in Figure 10.

‘On-set imaging: production process’ made up 31.5% (n=3,389) of all Level 3 RTE. An example of this type of RTE included repeat verification imaging due to incorrect field size or equipment malfunction during image acquisition. As illustrated in Figure 10, 62.7% (n=2,126) of these events were attributed to equipment or IT failure during image acquisition, an increase from the previous biennial period (55.9%).

This was followed by ‘management of variations, unexpected events’ with 15.7% of reports (n=1,691). The contributory factor ‘equipment or IT network failure’ was associated with 89.2% (n=1,509) of reports with this process subcode. Once again, this was an increase in proportion from the previous biennial period (83.3%). An example is when a patient is imaged and VMAT treatment initiated, however a machine fault occurs midway through an arc, so the patient is taken to a different treatment unit, receiving a further imaging exposure and remaining treatment delivered.

Figure 10. Breakdown of most frequently reported Level 3 RTE by process subcode (n=8,102 out of 10,751 RTE), includes equipment failure related

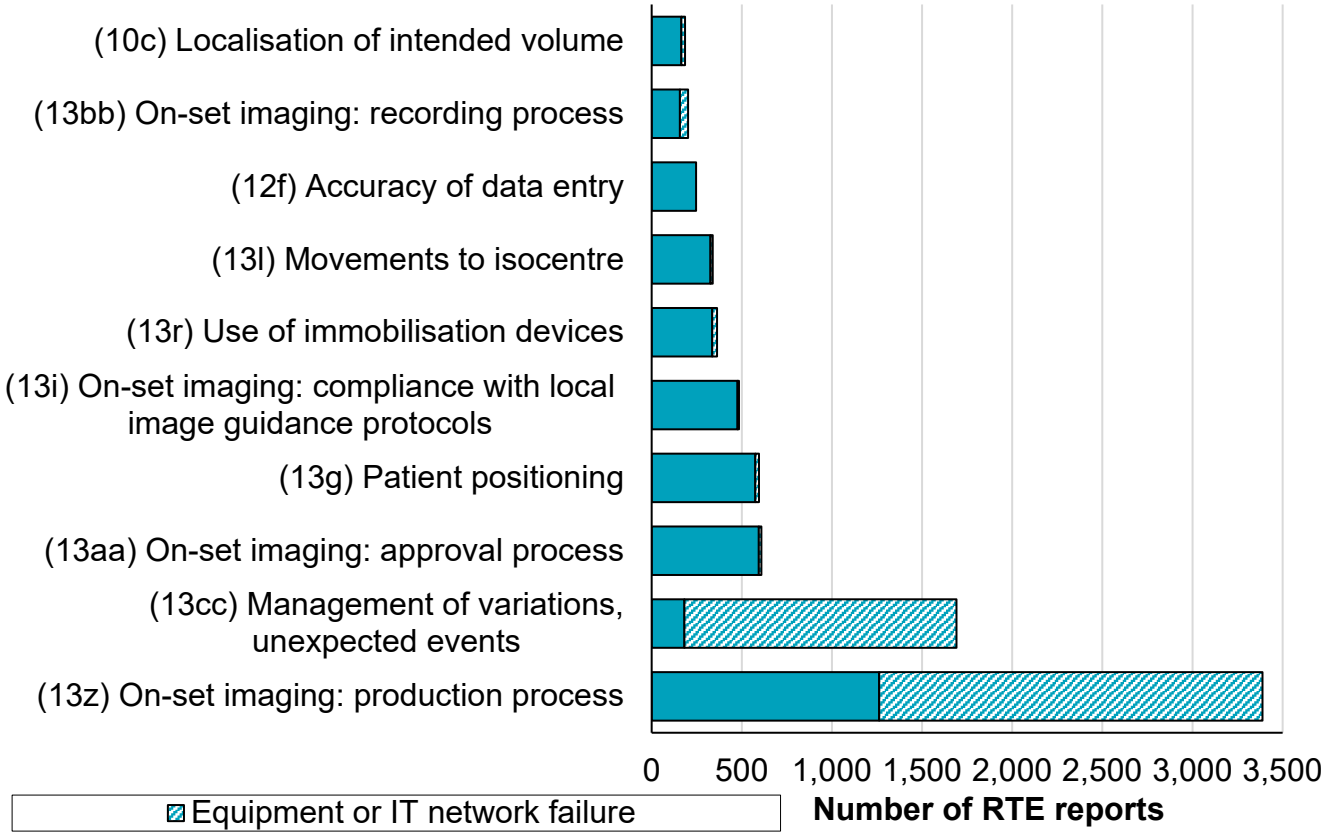
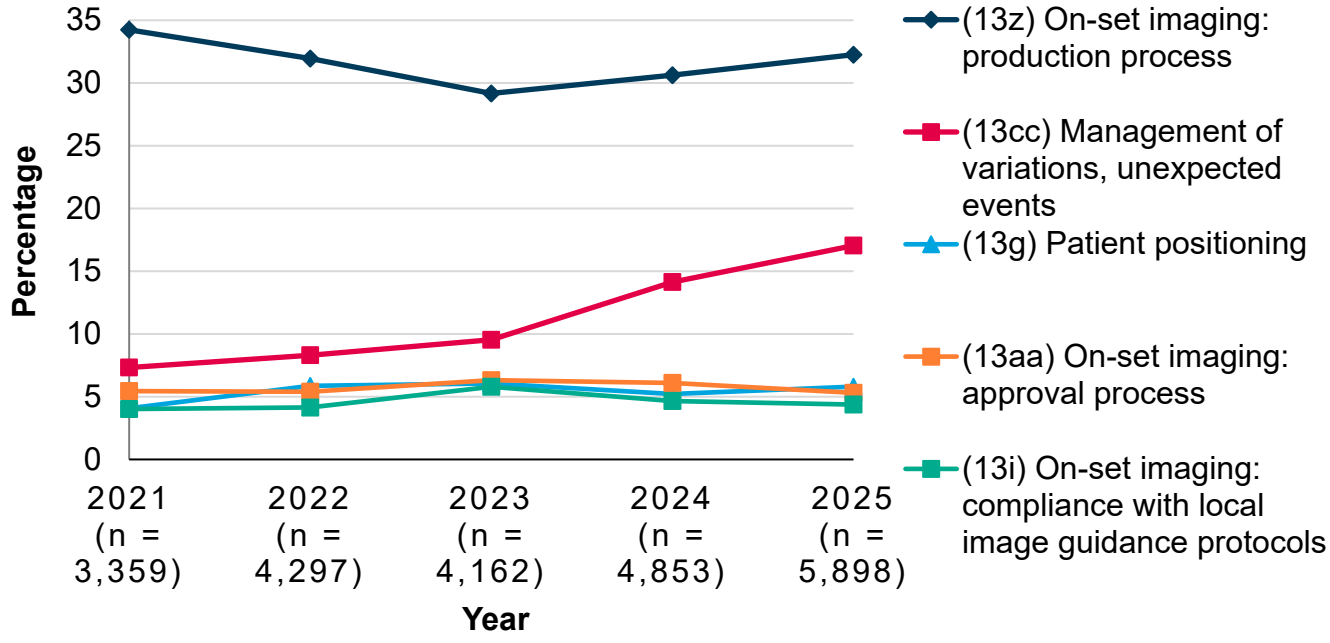


Figure 11 identifies trends by year across a 5-year period; 2021 to 2025. For the Level 3 RTE related to 'on-set imaging: production process', the rate has increased from a trough of 29.2% during 2023 to 32.3% in 2025, and the overall 5-year trend for this decrease was not statistically significant.

Figure 11. Trends for most frequently reported Level 3 RTE by process subcode (January 2021 to December 2025)



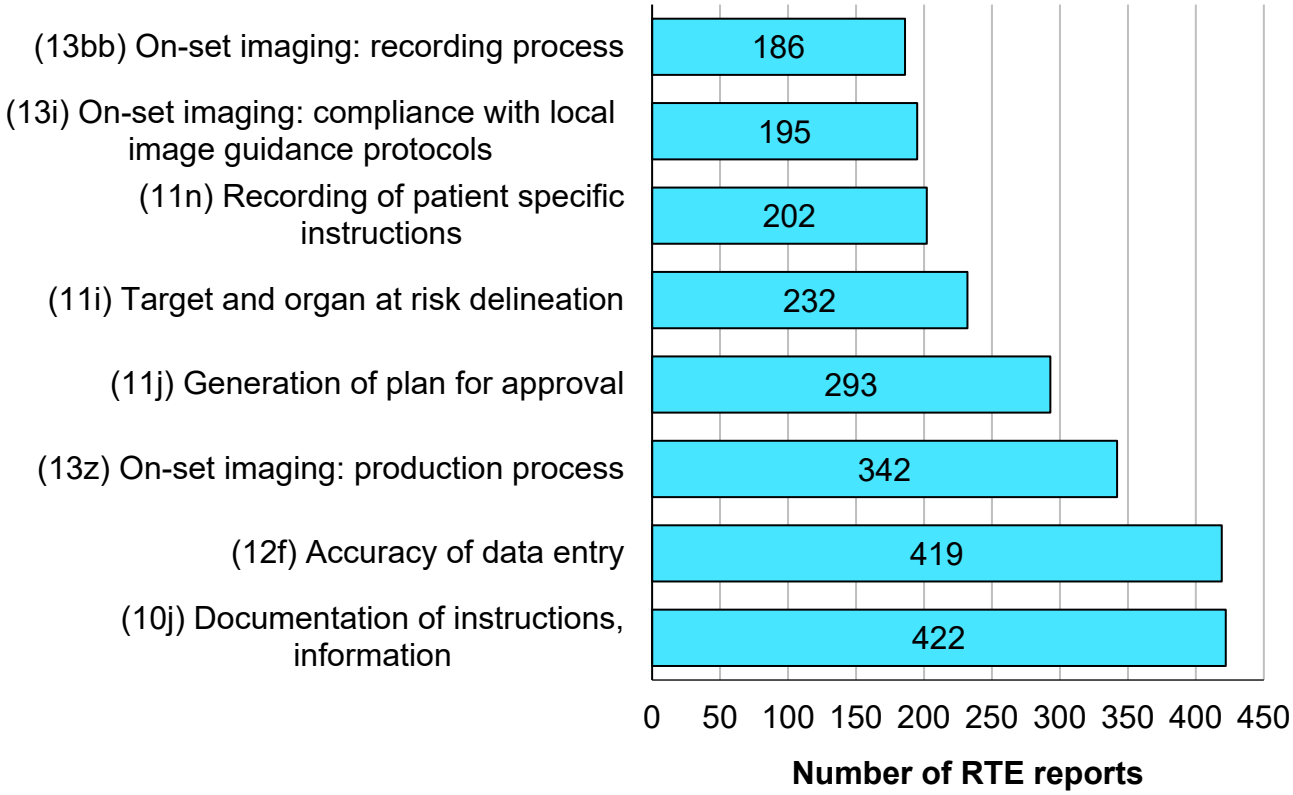
'Management of variations, unexpected events' percentage has demonstrated a significant (p=0.01) increase year on year since 2021 (7.3% in 2021 to 17.0% in 2025). The proportion of these reports associated with contributory factor 'equipment or IT network failure' increased from 78.9% in 2021 to 89.0% in 2025. The other most frequently reported pathway subcodes shown in Figure 11 demonstrated minimal variance over the 5-year period.

Good catch (Level 4 RTE)

A 'good catch', as defined in National patient safety radiotherapy event taxonomy, involves the interception and prevention of a potential RI or MRI incident There were 186 different subcodes associated with 6,020 Level 4 RTE. These were reported by all providers. The most frequently reported RTE can be seen in Figure 12.

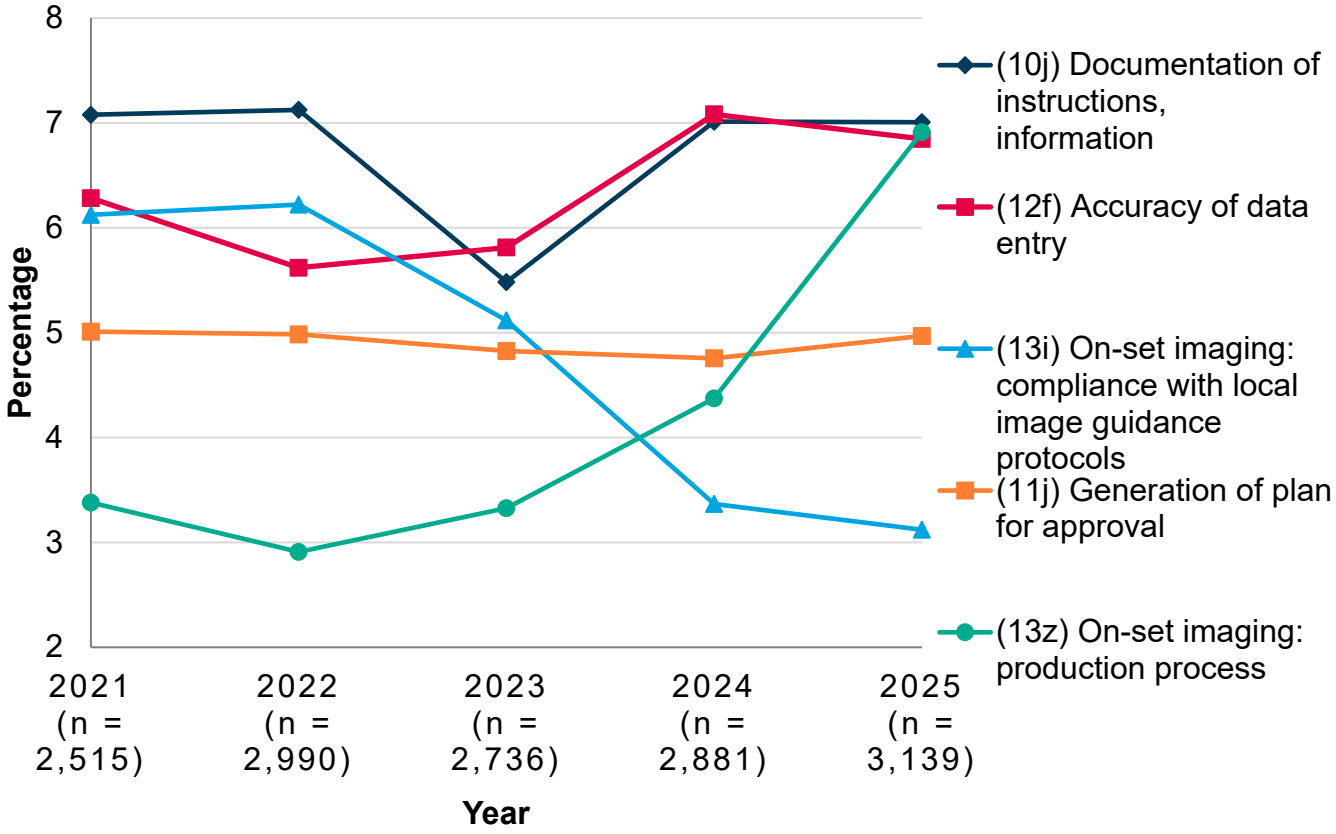
The most common Level 4 RTEs were 'documentation of instructions/information' (7.0%, n=422) and 'accuracy of data entry made' (7.0%, n=419). Examples include missing patient positioning details, and incorrect imaging filters identified before use, respectively.

Figure 12. Breakdown of most frequently reported Level 4 RTE by process subcode (n=2,291 out of 6,020 RTE)



As seen in Figure 13, 'documentation of instructions/information' fell to 5.4% in 2023 before increasing to 7% in 2024 and 2025. 'Accuracy of data entry' rose overall from 5.6% (2022) to 6.8% (2025). There was a statistically significant reduction of 'on-set imaging: compliance with local image guidance protocols' (p=0.01), while 'on-set imaging: production process' increased from 2.9% (2022) to 6.9% (2025) though this was not statistically significant.

Figure 13. Trends for most frequently reported Level 4 RTE by process subcode (January 2021 to December 2025)



Other non-conformance (Level 5 RTE)

Other non-conformance is defined as a non-compliance with some other aspect of a documented procedure but not directly affecting radiotherapy delivery.

Level 5 RTEs included 203 different subcodes across 8,283 reports from all providers. This is the first biennial report where all providers have shared Level 5 reports. The most frequently reported RTE are represented in Figure 14. The most common were ‘bookings made according to protocol’ (6.2%, n=515) and ‘communication of appointments to patient’ (5.2%, n=433).

Figure 14. Breakdown of most frequently reported Level 5 RTE by process subcode (n=3,145 out of 8,283 RTE)

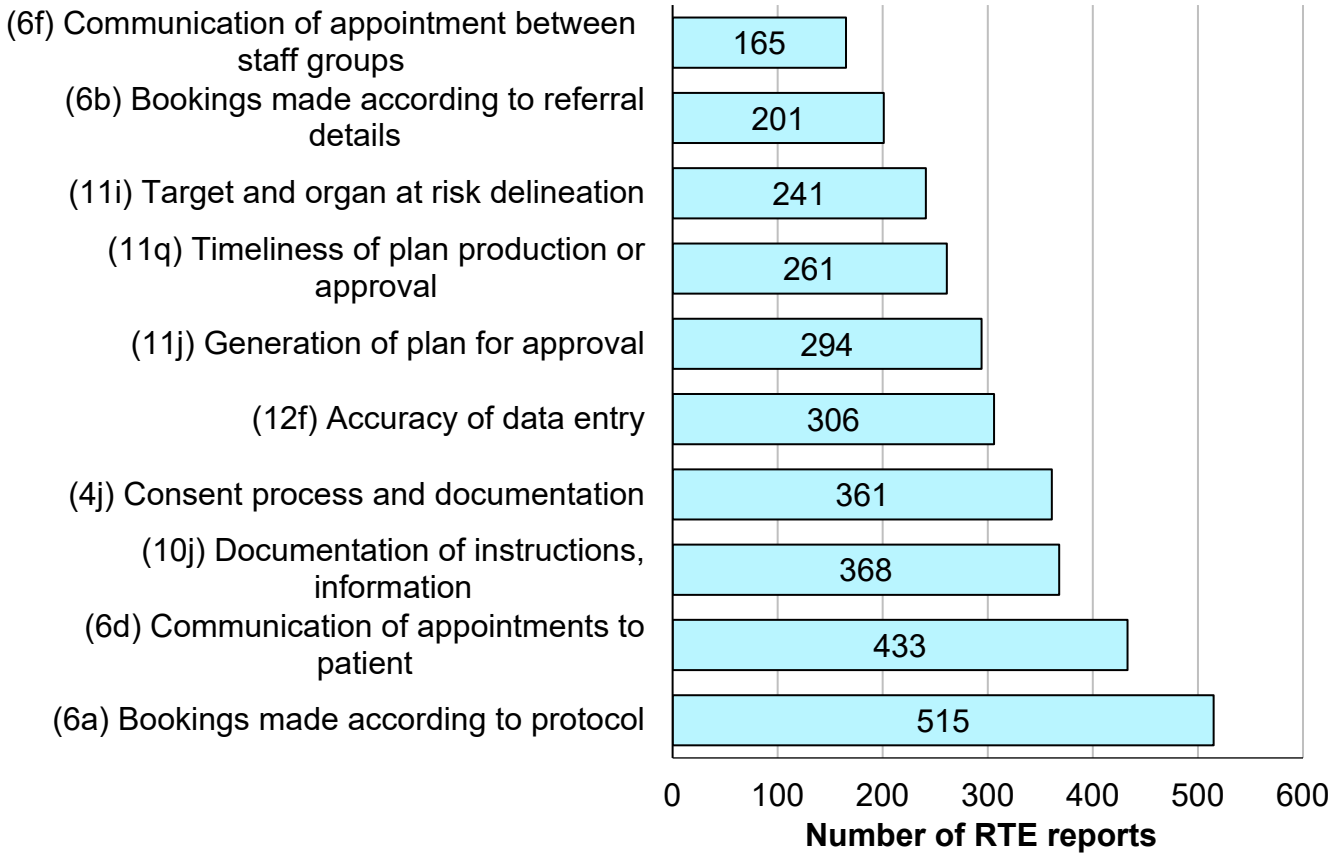
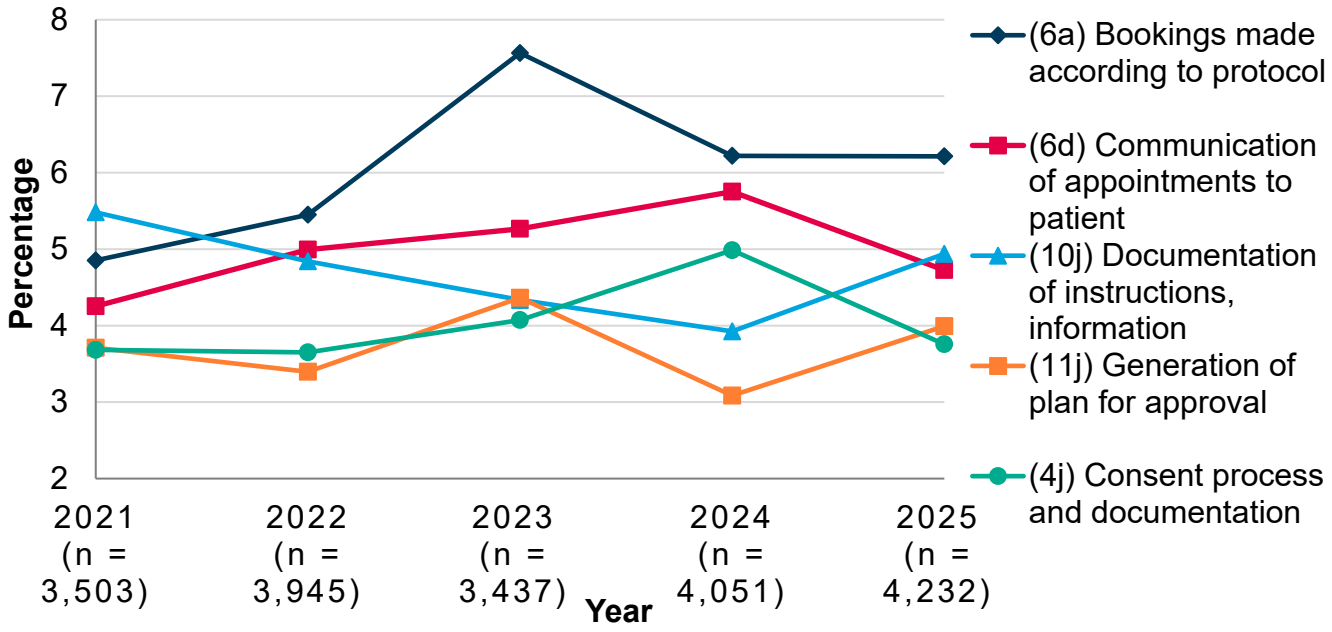


Figure 15 identifies trends by year across the preceding 5-year period. Having reduced in occurrence, the Level 5 RTE associated with 'documentation of instructions/information' increased from 3.9% in 2024 to 4.9% in 2025. 'Bookings made according to protocol' has decreased from a peak of 7.6% in 2023 to 6.2% in 2024 and 2025.

Figure 15. Trends for most frequently reported Level 5 RTE by process subcode (January 2021 to December 2025)



Reports associated with the process subcode ‘Communication of appointments to patients’ grew in proportion from 4.3% in 2021 to 5.8% in 2024 but dropped to 4.7% in 2025. None of these process subcode showed a statistically significant 5-year trend.

Safety barriers

In 2016 safety barriers were incorporated into the national patient safety radiotherapy event taxonomy, defined as critical control points or processes designed to prevent errors within the RT workflow. Initially, 86 pathway subcode were classified as safety barriers.

The definition of safety barriers was reviewed and updated within Advancing Safer Radiotherapy, and has since been adopted by the PSRT:

“Safety barriers are defences or functions deliberately inserted into the pathway to prevent, mitigate, or contain incidents. These are over and beyond core tasks undertaken as part of the planning and delivery of radiotherapy treatment.”

This provided an opportunity to redefine safety barriers as intentional defences added beyond core RT planning and delivery tasks to prevent or mitigate incidents. Reassessment of all taxonomy pathway subcodes identified 56 that met this updated definition (see Appendix 1).

The National patient safety radiotherapy event taxonomy also introduced more detailed coding for pretreatment imaging and on treatment end of process checks. While this improves insight into potential safety barriers, it has temporarily biased analysis by fragmenting the original codes. Therefore, for this analysis, these end of process checks are grouped together.

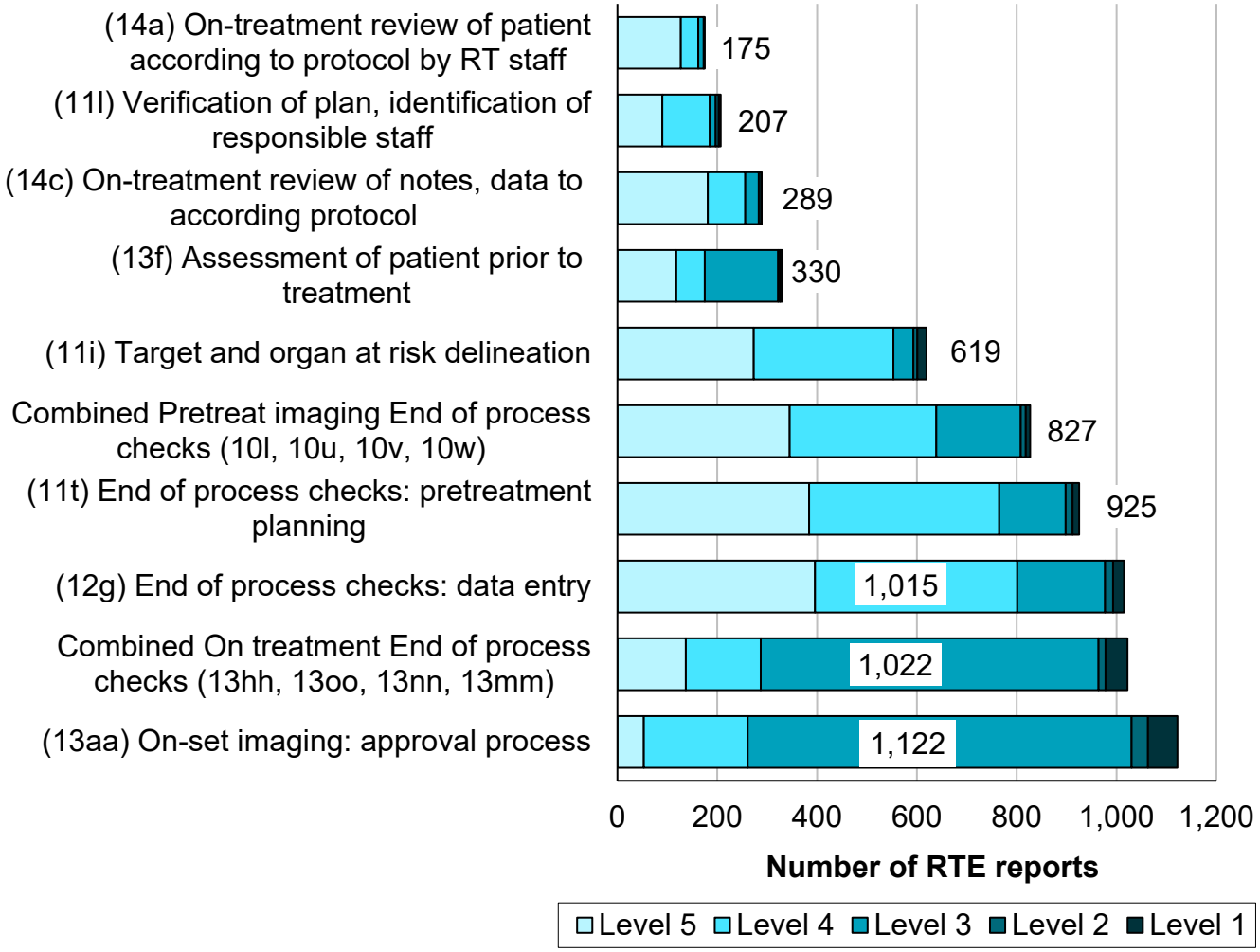
Ineffective safety barriers

An ineffective safety barrier is a defence or function that did not perform its intended safety role when required, to prevent, mitigate, or contain an incident. Analysis of ineffective safety barriers can provide insight into how events bypass existing defences, identifying weaknesses within the treatment pathway and informing the development of more effective controls. Ineffective safety barriers are identified from UKHSA analysis as primary, or other, pathway subcodes across all levels of RTE.

Multiple safety barrier codes can be linked to a single RTE, with 9,205 ineffective safety barriers identified across RTE reports. The most frequently reported are shown in Figure 16.

Treatment unit processes were attributed to 34.5% (n=3,173) of all ineffective safety barriers. ‘On-set imaging: approval process’ was the most frequently reported (12.2%, n=1,122). ‘End of process checks’ from all relevant areas of the pathway are the second to the fifth most frequently cited ineffective safety barriers and combined make up 41.2% (n=3,789) of all safety barriers.

Figure 16. Breakdown of most frequently reported ineffective safety barriers (n=6,531 out of 9,205 RTE)

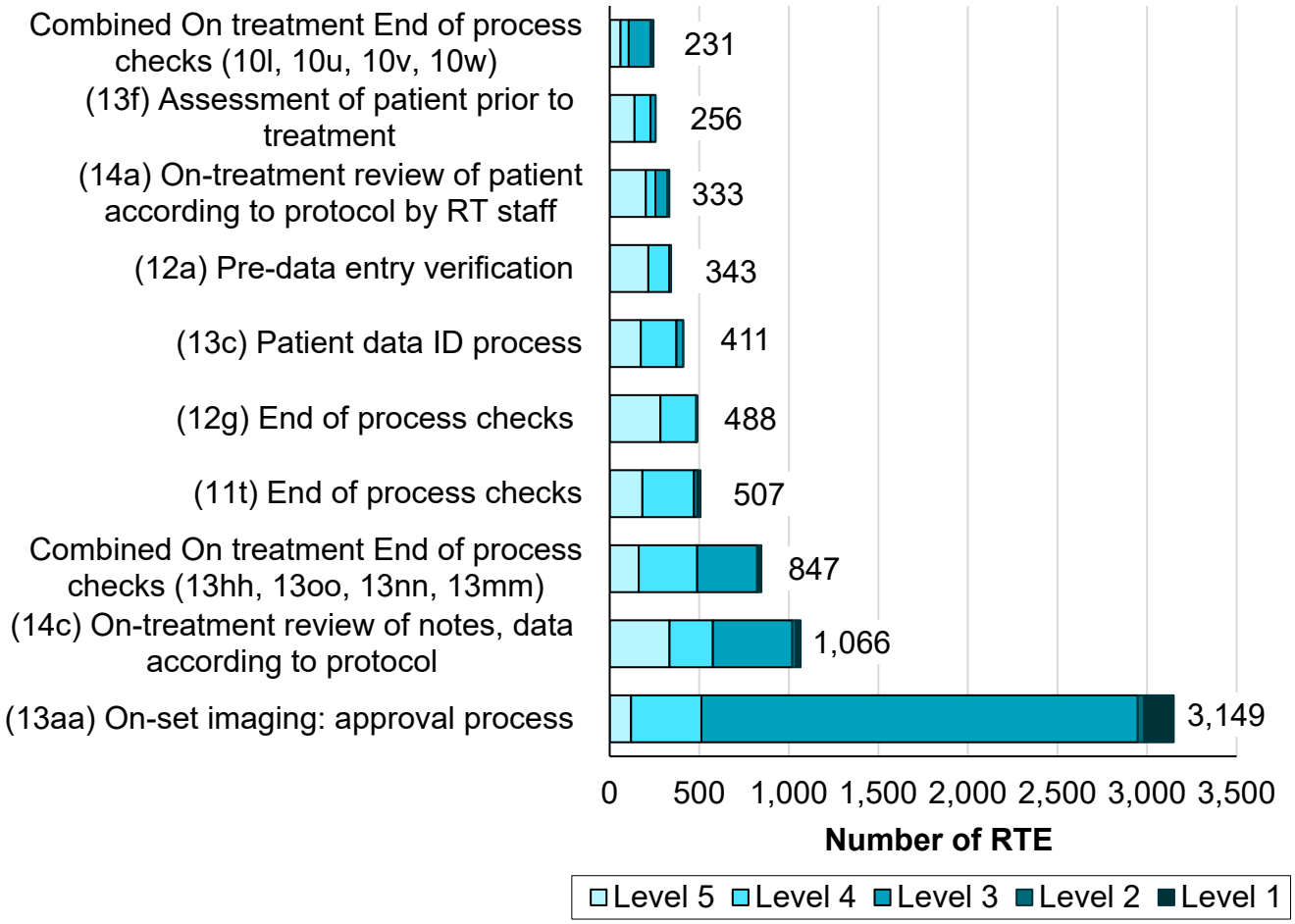


Effective safety barriers

Effective safety barriers are controls, processes, or human interventions that function as intended to prevent an error from occurring, mitigate its consequences, or contain its impact and are identified from UKHSA analysis as methods of detection (MD) across all levels of RTE. Analysis of effective safety barriers provides insight into the resilience of treatment processes by identifying which controls successfully detected or intercepted an event. Understanding safety barrier performance supports continuous quality improvement, enhances patient safety, and contributes to a proactive safety culture.

Figure 17 shows the most common effective safety barriers over the last biennial period. ‘On-set imaging – approval process’ is the most categorised as a method of detection (31.0%, n=3,149). ‘On-treatment review of notes, data according to protocol’ was the second most effective safety barrier (10.5%, n=1,066).

Figure 17. Breakdown of most frequently reported effective safety barriers (n=7,631 out of 10,144 RTE)



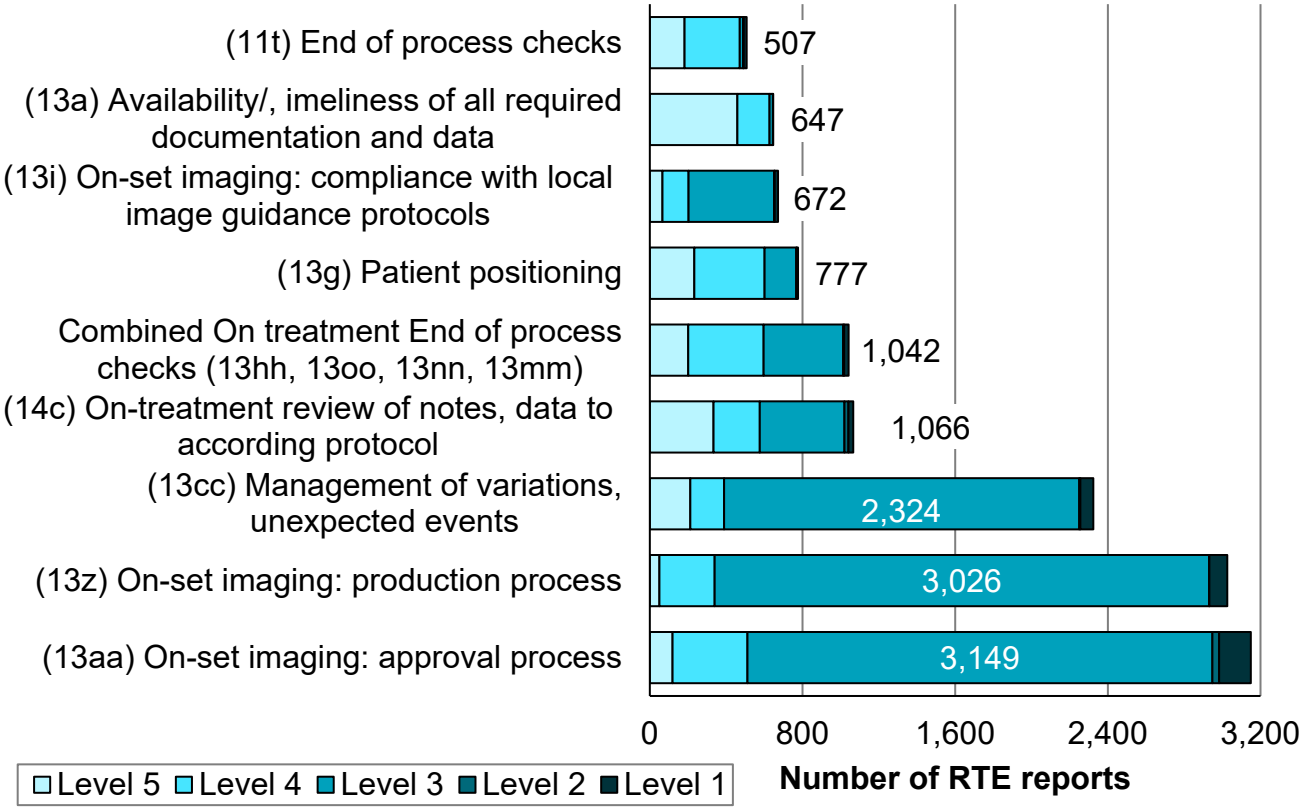
Method of detection

A method of detection (MD) is the process that identified an event and the entire RT pathway taxonomy within the National patient safety radiotherapy event taxonomy can be employed. Similarly to the approach taken with safety barriers, with the introduction of more detailed coding for pretreatment imaging and on treatment end of process checks, for this analysis, these end of process checks are grouped together

MD coding was provided, by all providers, in 63.4% (n=16,382) of reports, an increase on 52.2% from the previous 2-year period. Following consistency checking, UKHSA coded a further 7,502 reports with MD taxonomy using information within the reporting text. This resulted in 92.5% of reports (n=23,884) coded for analysis. This is an increase from the previous 2-year period when 89.1% reports contained a MD after consistency checking.

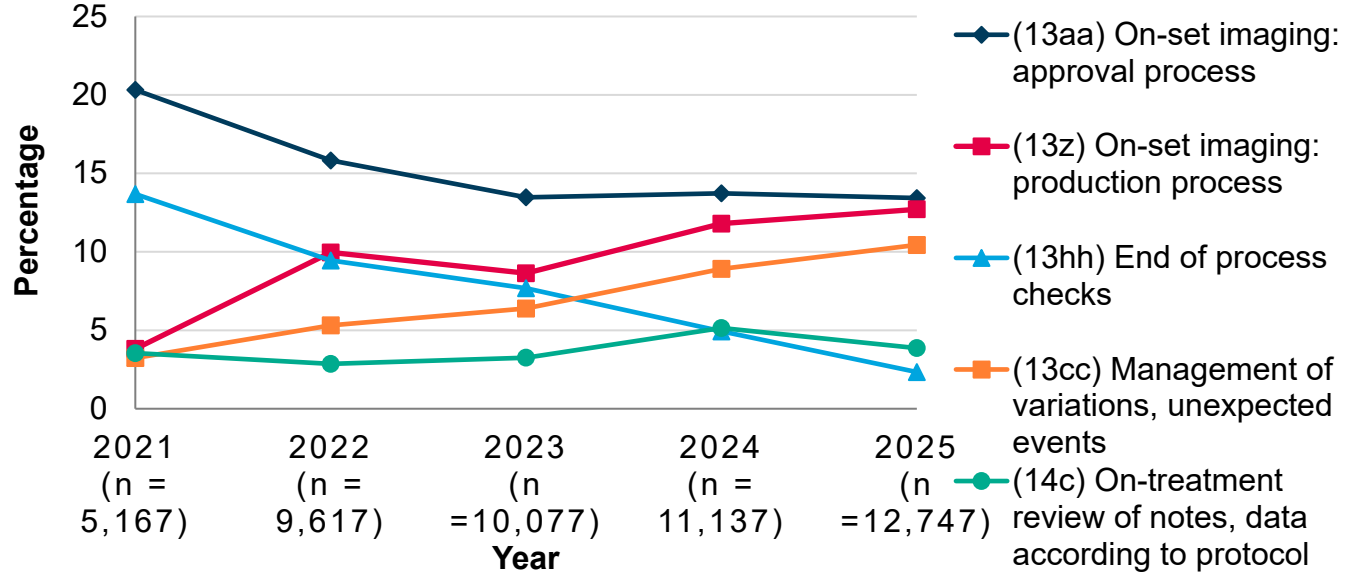
The most frequently reported methods of detection can be seen in Figure 18. The most frequently reported was ‘on-set imaging: approval process’ (13.2%, n=3,149). This MD includes both online and offline verification processes and was most frequently reported with a primary process subcode ‘on-set imaging: production process’ (21.9%, n= 689).

Figure 18. Breakdown of method of detection by level (n=13,015 out of 23,884 RTE)



Trend analysis of methods of detection shown in Figure 19 demonstrates notable increases in the proportion of both ‘‘on-set imaging: production process’ (3.8% in 2021 to 12.7% in 2025) and ‘management of variations, unexpected events’ (3.2% in 2021 to 10.4% in 2025), both 5-year trends were considered statistically significant (p=0.05 and p=0.001, respectively). Process subcode ‘on treatment: end of process checks’, demonstrated a statistically significant decrease (p=0.001) from 13.7% in 2021 to 2.3% in 2025. The combined on treatment end of process checks were 3.9% in 2025.

Figure 19. Trends for most frequently reported methods of detection by process subcode (January 2021 to December 2025)



Contributory factors

Including contributory factors in the RTE taxonomy helps identify underlying system issues that may lead to events (12).

Multiple contributory factors can be assigned to a single RTE. Of 25,831 RTEs, 25,228 included a primary contributory factor. RTEs can include multiple contributory factors, and 5,757 RTEs contained more than one factor (n=7,187), giving 32,415 contributory factors for analysis. All 59 providers applied contributory factor coding.

Figure 20 shows the most frequently reported contributory factors codes. The most common contributory factor was ‘slips and lapses’ (26.6%, n=8,637), typically cited for routine, well-practiced tasks. This was followed by ‘adherence to procedures or protocols’ (20.2%, n=6,545), employed when established processes were not followed.

Figure 20. Breakdown of most frequently reported contributory factors (n=30,133 out of 32,415 contributory factors)

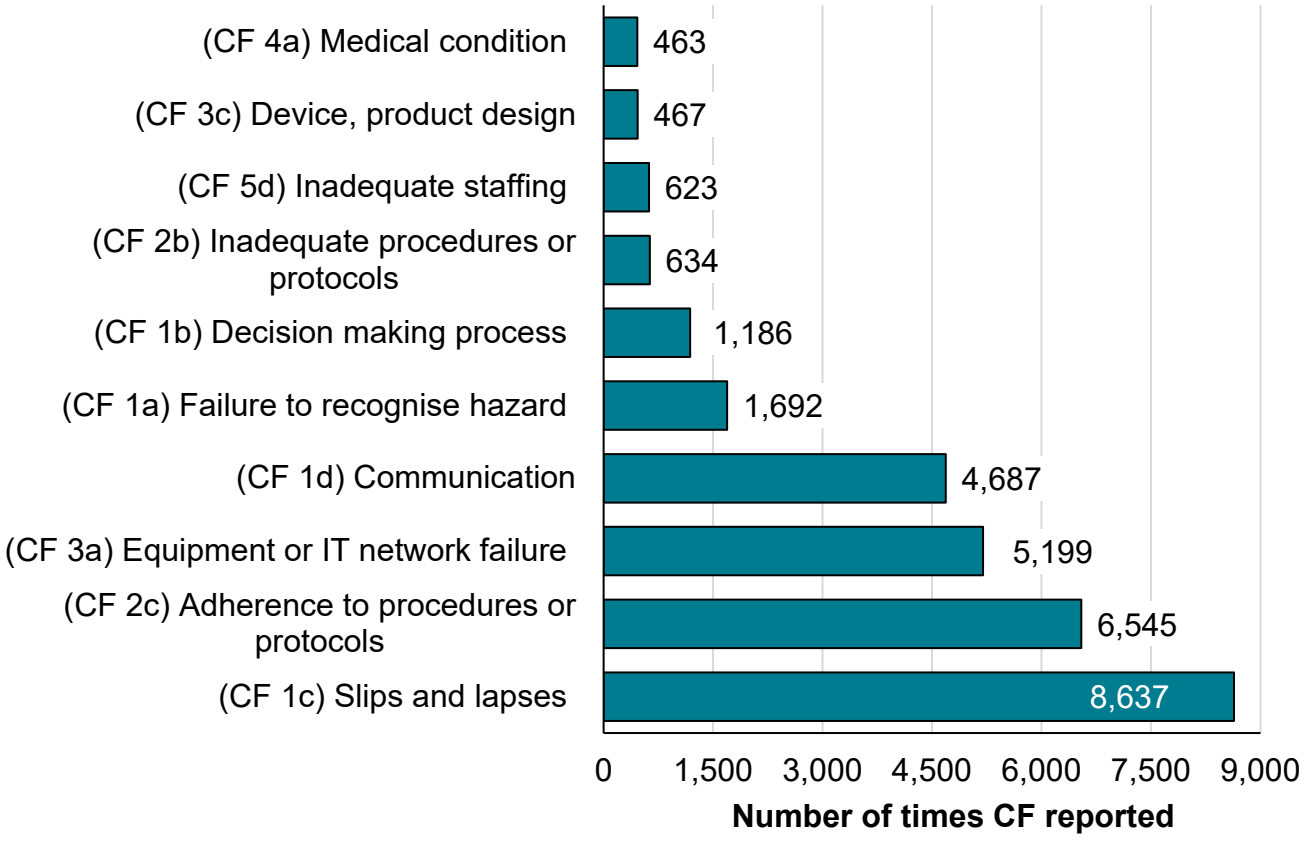
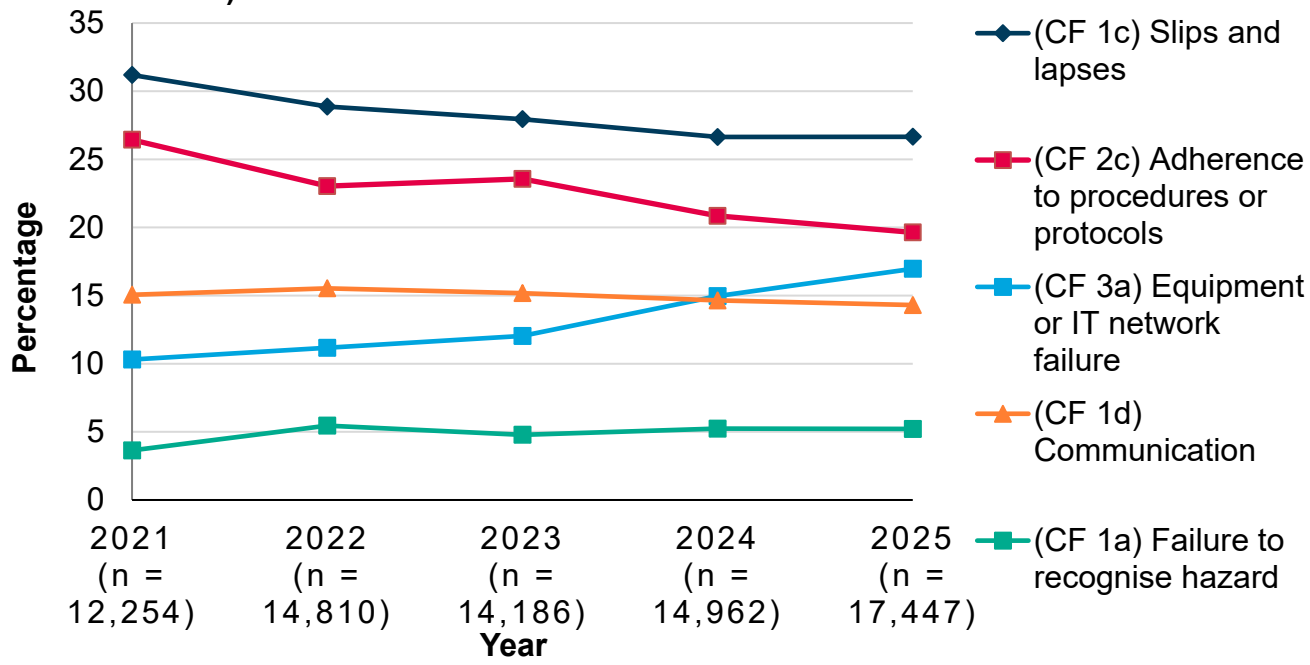


Figure 21 indicates the trends across the preceding 5-year period for the most frequently reported contributory factors are broadly consistent. ‘Slips and lapses’ declined from 31.2% in 2021 to its current level of 26.7%, whilst ‘adherence to procedures or protocols’ declined from 26.4% to 19.6%. Both these decreasing trends are considered statistically significant (p=0.02 and p=0.01 respectively). Conversely, ‘equipment or IT network failure’ had a statistically significant increase (p=0.01) from 10.3% in 2021 to 17.0% in 2025.

Figure 21. Trends for most frequently reported contributory factors (January 2021 to December 2025)

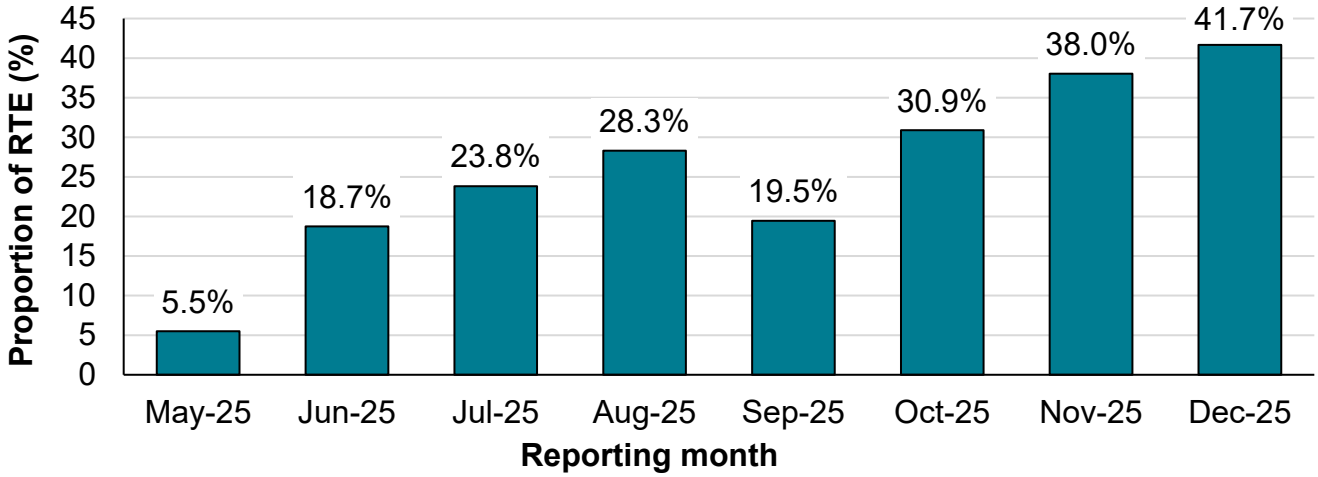


Modality taxonomy

National patient safety radiotherapy event taxonomy, published in May 2025, introduced the modality taxonomy as a means of differentiating the type of treatment being planned, or delivered, within the RTE data. Modality codes can be applied for pretreatment events if the intended technique is known or becomes known during RTE investigation. If the treatment modality cannot be established, then the code should be omitted. When applying the taxonomy, a D should prefix the Modality code, for example D02.

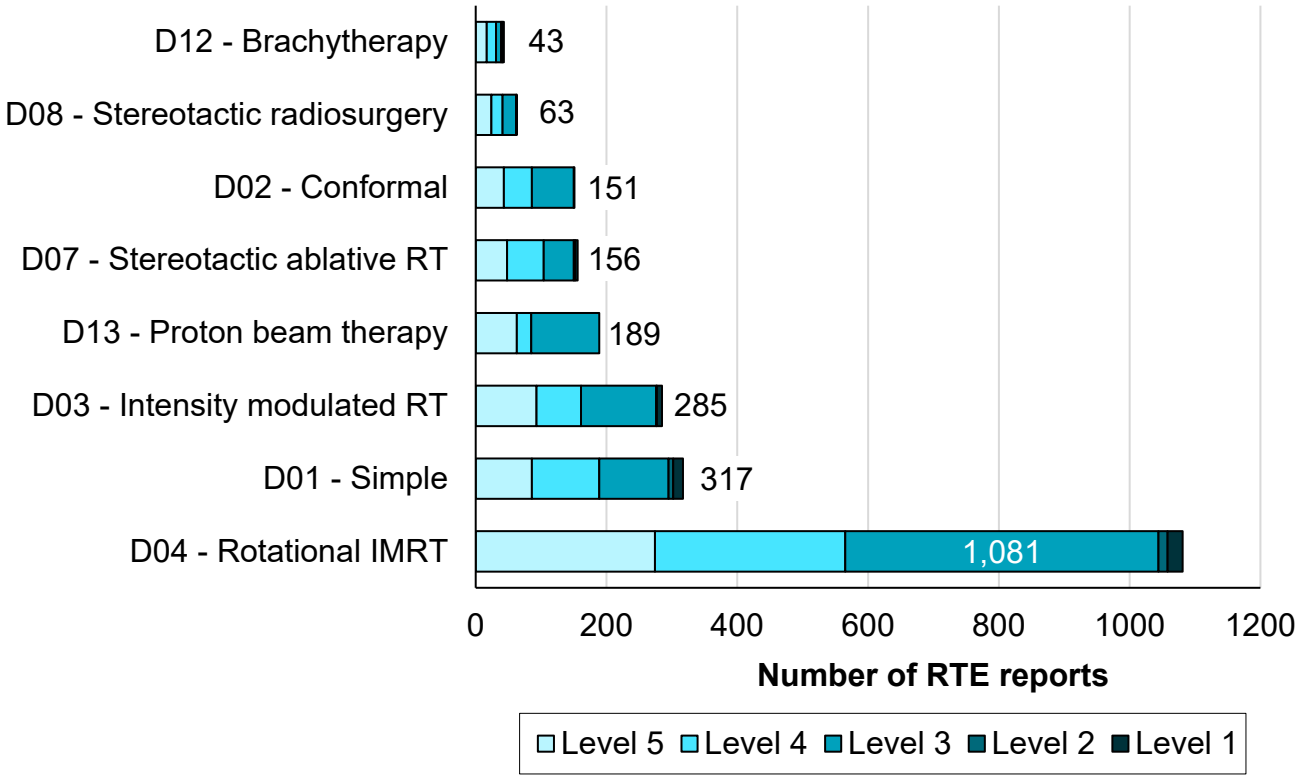
Figure 22 illustrates the proportion of RTE submitted each month since the taxonomies' introduction. There has been overall growth since May 2025 when only 5.5% of reports were assigned a modality code. The last month of this biennial reporting period was December 2025, where 41.7% of RTE were assigned a modality code.

Figure 22. Frequency of modality coding from May to December 2025



The most frequently reported modality codes are shown in Figure 23, broken down by level.

Figure 23. The most frequently reported modality code (n=2,285 out of 2,366)

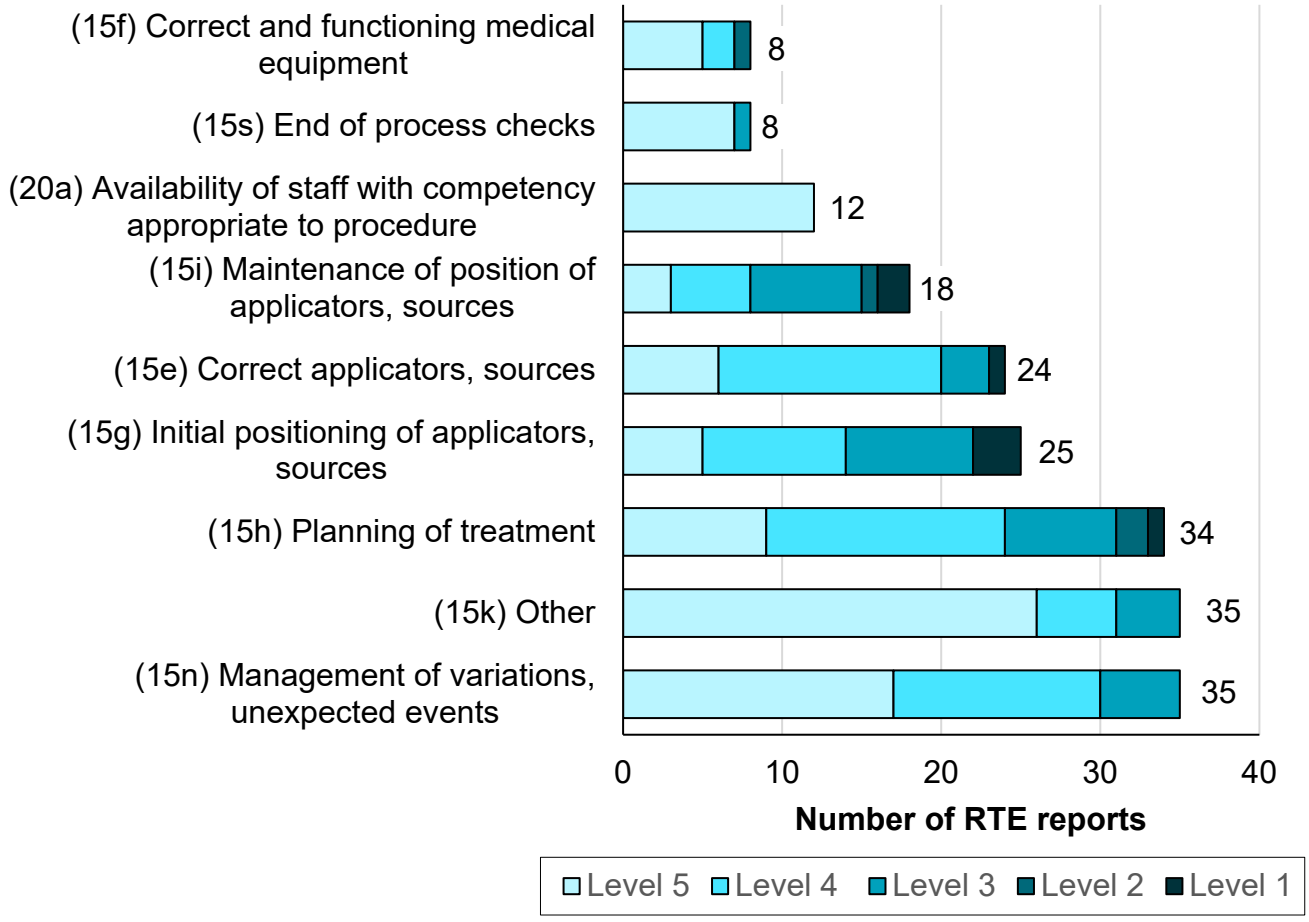


Brachytherapy RTE

Brachytherapy (BRT) involves placing a sealed radiation source within or close to a treatment area (13). Data from 34 providers was received, up from 31 in the previous period. BRT accounts for less than 3% of all RT episodes (14), this is reflected in its low reporting rates; 1.1% (n=293) of RTEs, consistent with the previous period. Due to small numbers, findings should be interpreted cautiously.

The proportion of Level 1 BRT RTEs increased to 3.8% (n=11) from 2.5% (n=6), exceeding the overall RTE rate (2.3%). This may relate to the hypo-fractionation nature of BRT (15), and the reliance on manual processes for planning and delivery. Conversely, Level 3 events were lower in BRT (14.0% versus 41.6%), While several factors may contribute to the lower proportion of Level 3 events reported in brachytherapy, including differences in imaging practices, differences in the maturity of reporting infrastructure, including ready access to ELSs, should be considered when interpreting these findings. Level 5 non-conformances were higher (49.5% versus 32.1%) potentially reflecting processes outside radiotherapy, such as anaesthetics and inpatient care.

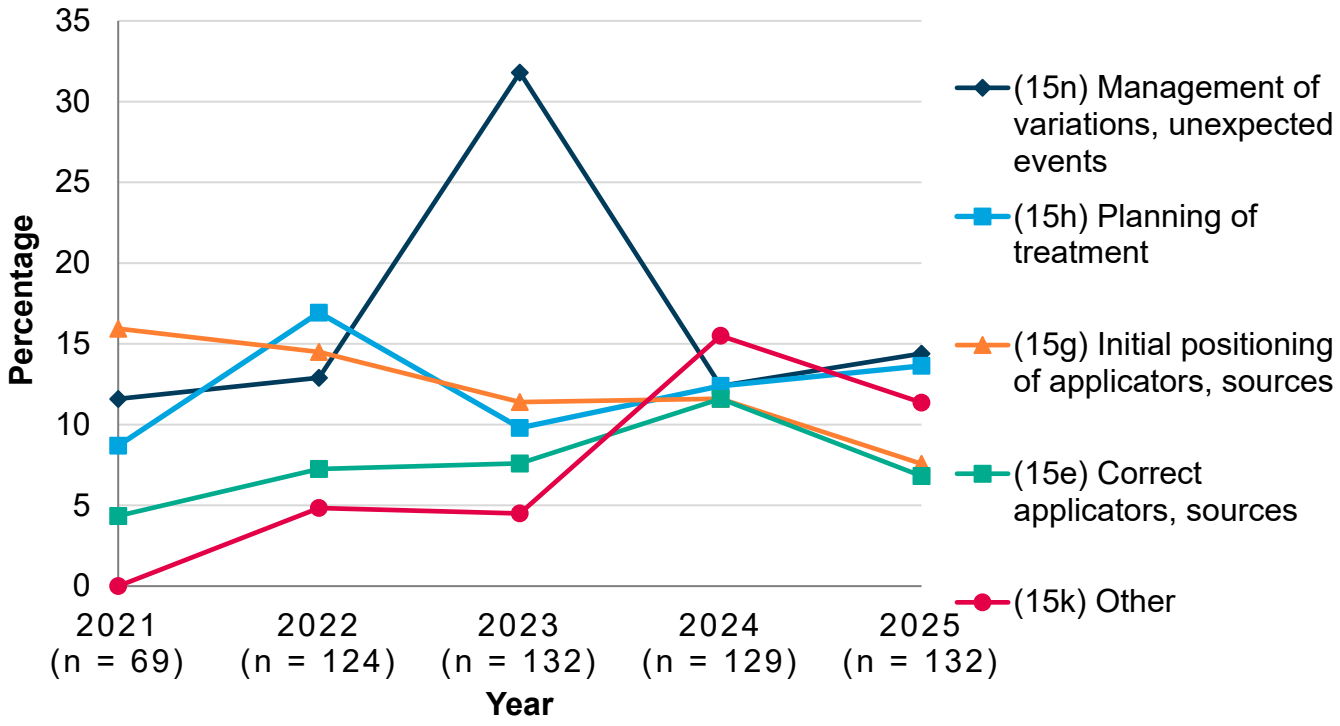
Figure 24. Breakdown of most frequently reported BRT RTE either coded ‘15’ or ‘D12’ by Level (n=199 out of 293 BRT RTE)



The most common BRT subcodes in Figure 24 were ‘management of variations, unexpected events’ and ‘other’ (both 11.9%, n=35). Over half of the former (51.4%, n=18) involved equipment or IT network failures, such as afterloader malfunctions or HDR kit defects. The frequent use of ‘other’ highlights past limitations in coding, though this has been addressed by the expanded National patient safety radiotherapy event taxonomy.

The yearly trends of the most frequently reported BRT RTE are shown in Figure 25. The most salient is a large increase in the proportion of ‘management of variations, unexpected events’ between 2022 and 2023 (12.9% and 31.8% respectively), although this subcode dropped back to 12.4% in 2024 and 14.4% in 2025.

Figure 25. Trends for most frequently reported BRT RTE by process subcode (January 2021 to December 2025)



Brachytherapy ineffective and effective safety barriers are derived from the 56 pathway subcodes identified as safety barriers in Appendix 1. Figure 26 shows the most common ineffective safety barriers.

Figure 26. Breakdown of BRT ineffective safety barriers (n=46 out of 53)

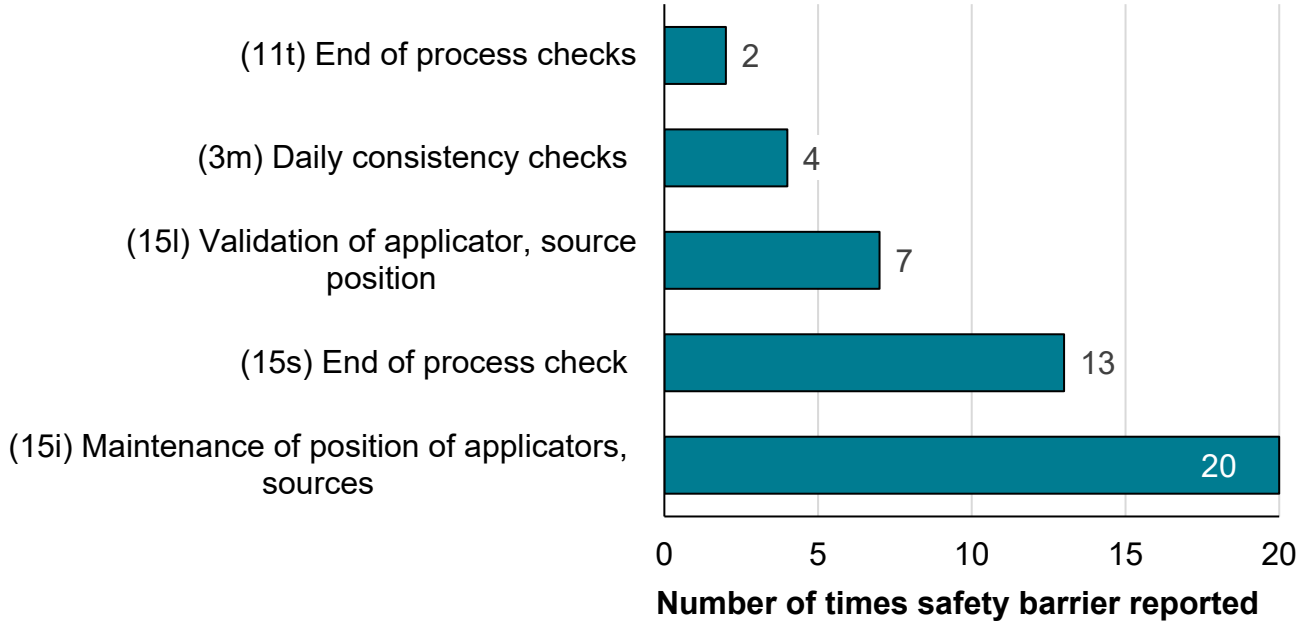
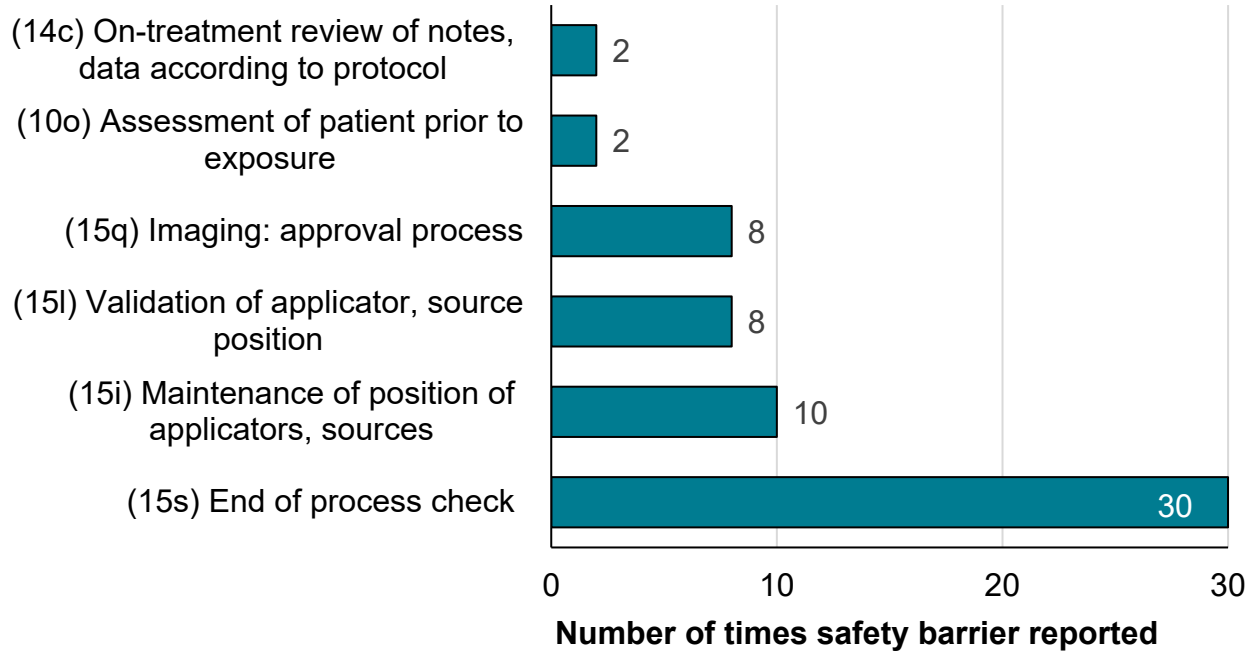


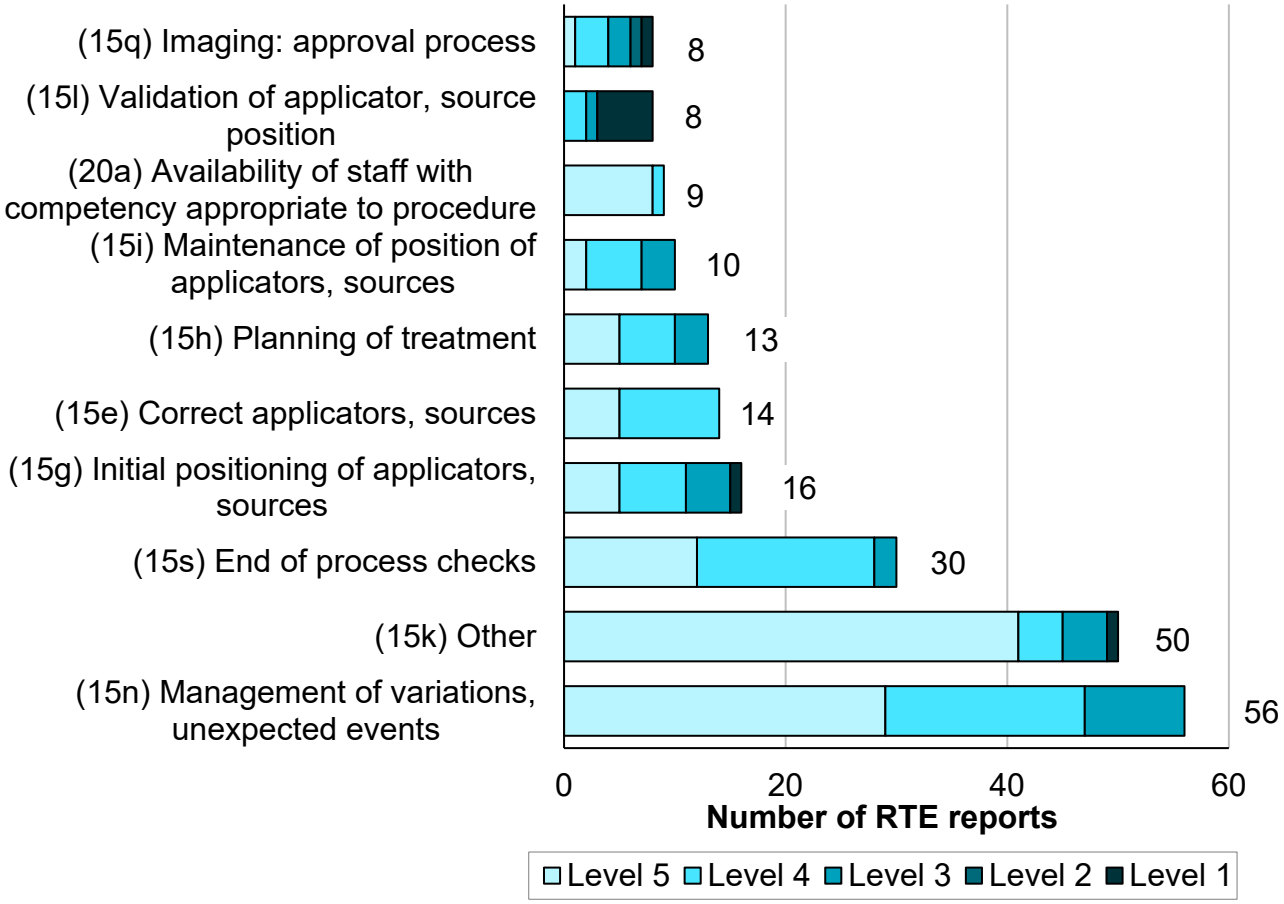
Figure 27 highlights the most commonly cited effective safety barriers, with end of process checks the most frequent.

Figure 27. Breakdown of BRT effective safety barriers (n=60 out of 66)



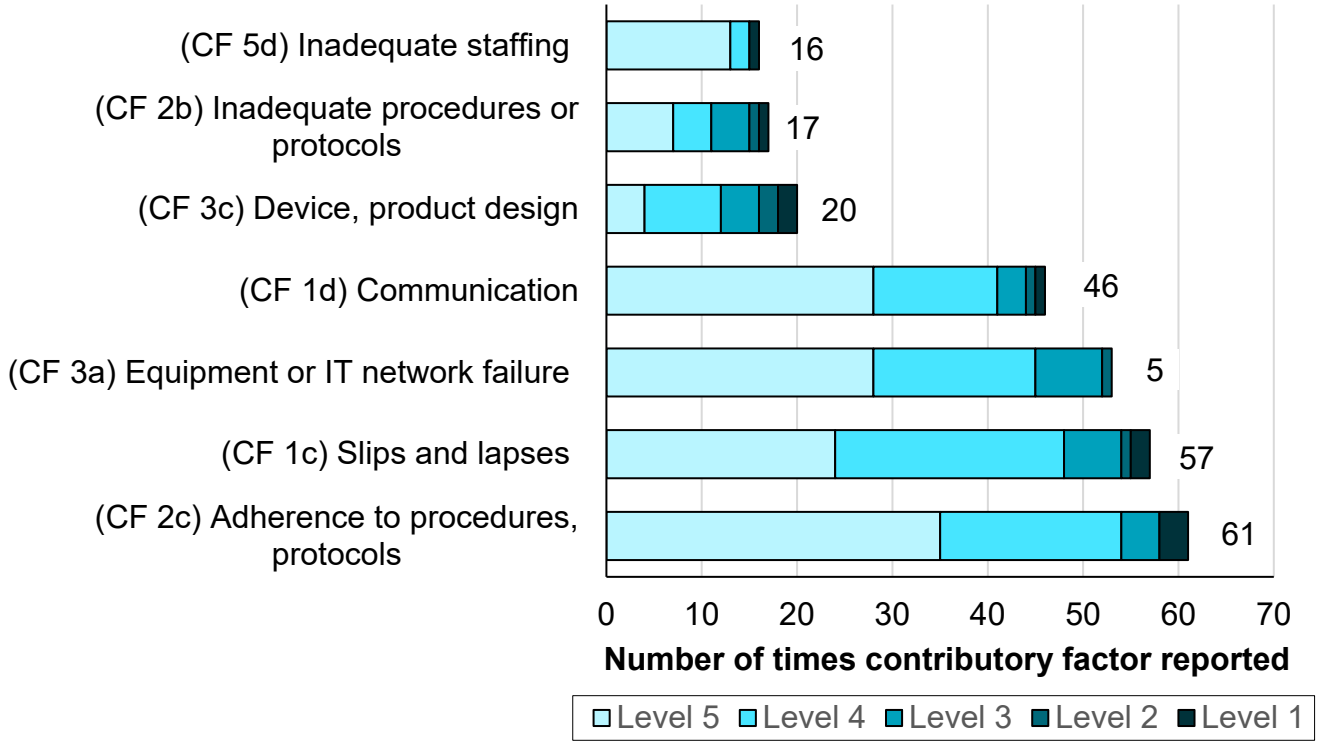
Of 293 BRT reports, 91.8% (n=269) included a MD pathway subcode (Figure 28), an increase from 90.0% (n=217) in the previous 2-year reporting period. The most common was 'Management of variations, unexpected events' accounting for 20.8% (n=56).

Figure 28. Breakdown of BRT method of detection by level (n=214 out of 269 BRT RTE)



Multiple contributory factors can be assigned to a single RTE. Across the 293 BRT RTE 341 contributory codes were reported. Figure 29 shows the most frequently reported BRT contributory factors. The most common contributory factor was ‘Adherence to procedures, protocols´ (17.9%, n=61), followed by ‘slips and lapses’ (16.7%, n=57), whilst ‘equipment or IT network failure’ contributed 15.5% (n=53).

Figure 29. Breakdown of BRT RTE contributory factors (n=270 out of 341)

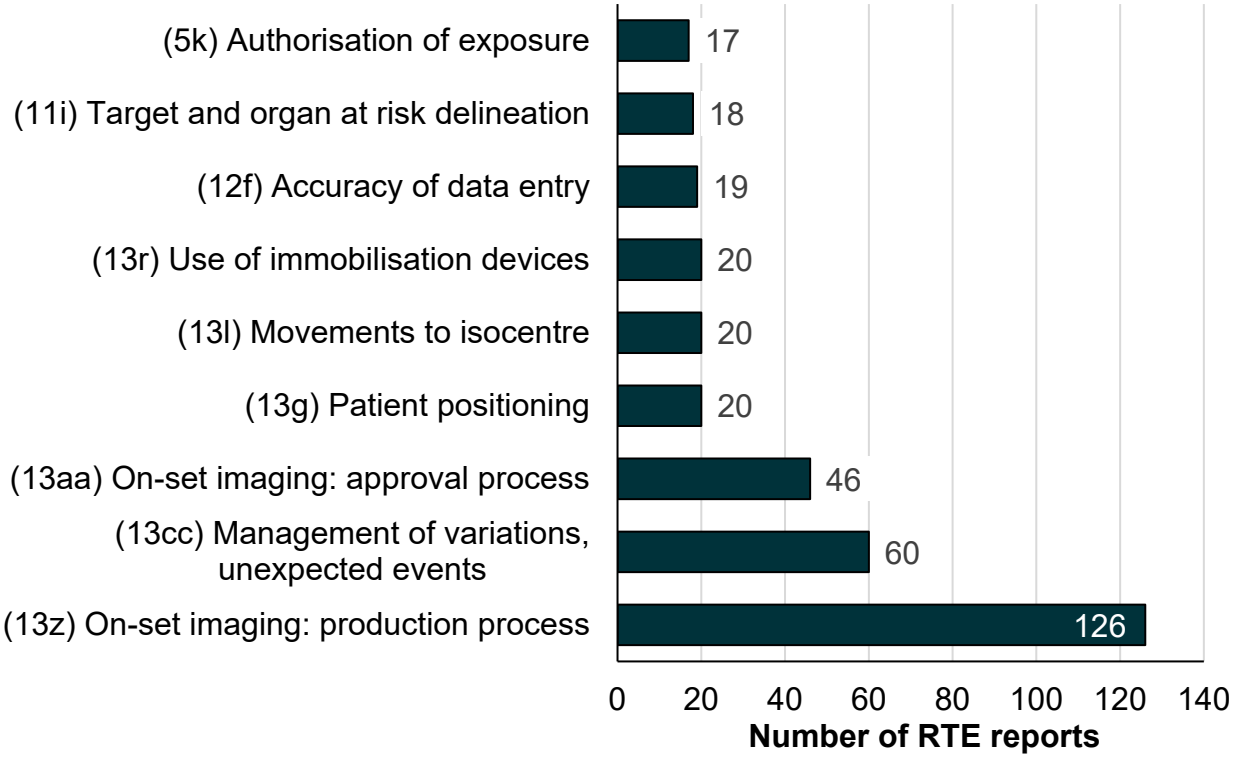


Inspectorate RTE

The IR(ME)R (8, 9) inspectorates for England, Northern Ireland, Scotland, and Wales shared a total of 536 anonymised synopses of closed radiation incidents for analysis. This represents an increase of 32.0% from 406 in the previous 2-year reporting period. This may partially be due to increases in patient attendance over the reporting period and likely influenced by changes to SAUE guidance during the reporting period. One report was left incomplete as it was shared without coding applied and without the requisite text to assign any coding. Another report was shared voluntarily as a level 3 report. This left 534 reportable radiation incidents for analysis.

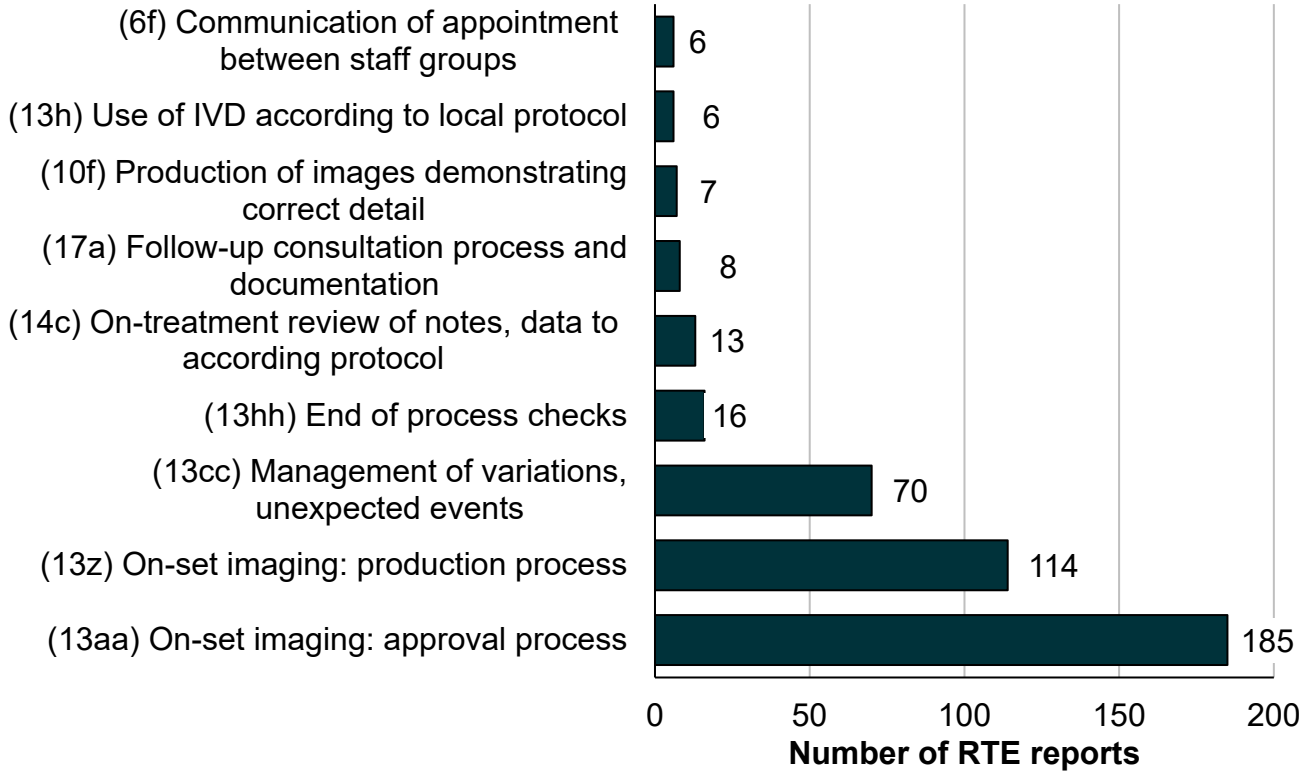
Process subcode ‘on-set imaging: production process’ (23.6%, n=126) has reduced slightly in proportion from 24.2% (n=98) since the previous 2-year report. It remains the most frequently occurring subcode within the inspectorate data (Figure 30). This was followed by process subcode ‘management of variations, unexpected events’ (11.2%, n=60) which has increased in proportion from 6.2% (n=25). Third subcode in frequency was ‘on-set imaging: approval process’ at 8.6% (n=46), an increase from 6.9% (n=28), whilst ‘patient positioning’ has reduced from 6.2% (n=25) to 3.7% (n=20).

Figure 30. Breakdown of most frequent inspectorate notifications by primary process subcodes (n=346 out of 534 RTE)



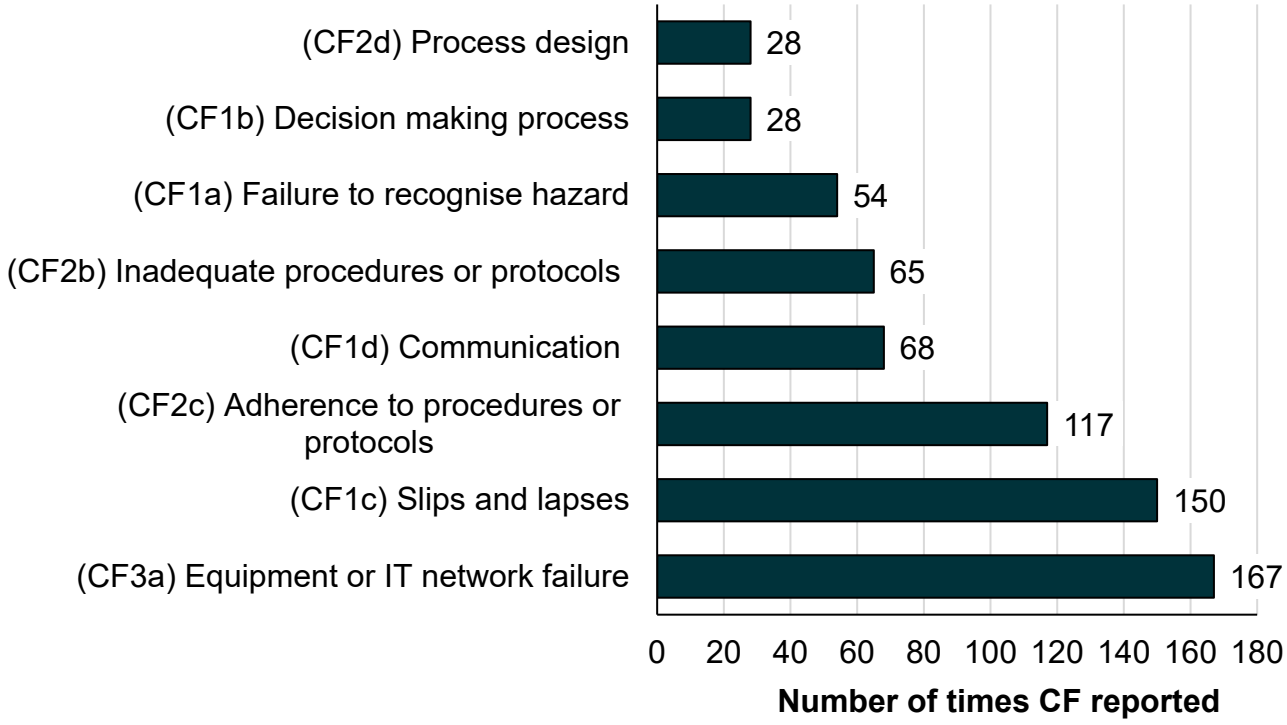
The most frequently reported methods of detection for inspectorate data can be seen in Figure 31. 'On-set imaging: approval process' was the most frequently reported at 37.0% (n=185), consistent with the previous 2-year report (37.5%).

Figure 31. Breakdown of most frequently reported inspectorate notifications by method of detection (n=420 out of 500 RTE)



There were 776 contributory factors assigned to the inspectorate reports. The most frequently reported contributory factors can be seen in Figure 32. The most frequently reported contributory factor was ‘equipment and IT network failure’ with 21.5% (n=167), followed by ‘slips and lapses’ (19.3%, n=150). ‘Equipment and IT network failure’ has demonstrated an increase from the previous 2-year report (16.1%), whilst ‘slips and lapse’ has reduced in proportion (29.5%)

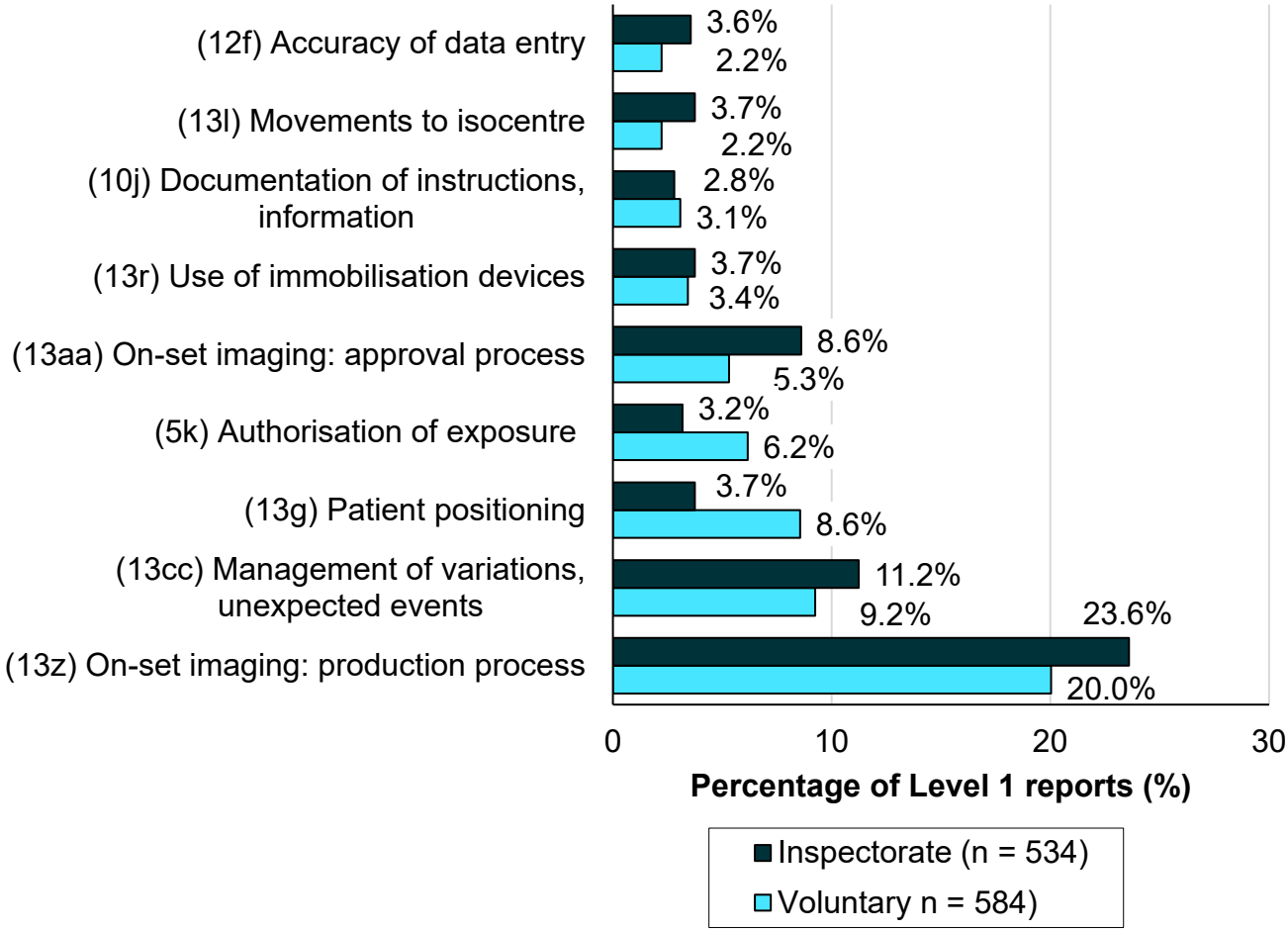
Figure 32. Breakdown of most frequently reported inspectorate notifications by contributory factor (n=677 out of 776 RTE)



Reporting numbers between voluntary and mandatory incident learning systems varied; a total of 584 Level 1 RTE were reported to the voluntary dataset within this 2-year period, and 534 closed synopses of reports were received from the inspectorates.

To better understand the variance in number of reports, a review of the incidents by date of occurrence (between January 2024 and December 2025) was carried out (Figure 33). The proportion of process subcode ‘on-set: production process’ was broadly similar between voluntary and mandatory reporting, there was a greater frequency of ‘management of variations, unexpected events’ and ‘on-set imaging: approval process’ in mandatory reporting, and fewer ‘patient positioning’ and ‘authorisation of exposure’.

Figure 33. Comparison of most frequently reported process subcodes in inspectorate and Level 1 voluntary data sets (Incident dates January 2024 to December 2025)



Discussion

Over the past 2 years, all UK NHS RT providers and some from independent providers have submitted reports to the national radiotherapy event learning system, demonstrating a strong community commitment to shared learning. This is supported by several drivers: IR(ME)R regulations (8, 9, 16) require local recording and analysis of events involving accidental or unintended exposures and a study of the risk as part of local quality assurance, enabling national collection of RTE data; NHS England include participation in national RTE learning for external beam service providers in England (17, 18); and the Francis report (19) emphasises openness, transparency, and candour to improve patient safety and eliminate poor practice.

Increase in reporting numbers

During this 2-year reporting period, 25,831 voluntary RTE reports were submitted, a 16.8% increase from 22,113 in the previous 2-year period. This rise exceeds the 4.9% increase in estimated radiotherapy attendances (14), suggesting improved reporting practices rather than more events, although underlying causes should still be examined. Increased reporting reflects a positive, transparent safety culture, especially when data is analysed and used to inform practice. The annual number also rose by 1,551 reports from 2024 (n=12,140) to 2025 (n=13,691), potentially influenced by the transition to LFPSE and the decommissioning of NRLS in June 2024.

Two primary pathway subcodes drove much of the increase in RTEs: ‘management of variations, unexpected events’ rose by 1,024 (n=2,022 versus n=998), and ‘on-set imaging: production process’ increased by 1,006 RTE (n=3,881 versus n=2,875). Together, these accounted for over half the total rise in RTE numbers (n=2,030 versus n=3,873) and are largely linked to equipment or IT network failure, cited in 62.8% and 83.7% of these events respectively.

RTE data quality

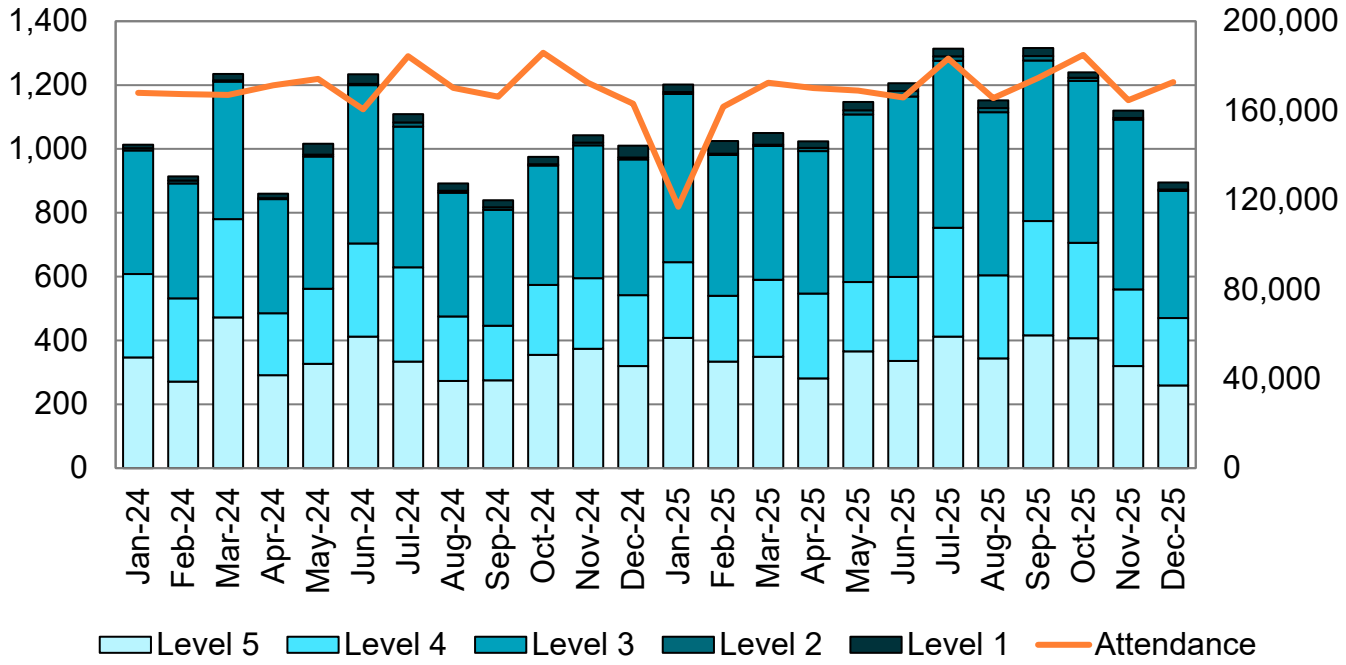
In this period 63.6% (n=16,657) of RTE reports were fully classified and coded by providers, an improvement from the previous 2-year period (58.4%, n=13,021). Use of modality taxonomy has steadily increased since its introduction in May 2025, and this is the first biennial report where all providers have shared Level 5 reports. UKHSA invites any providers who are experiencing any issues with national reporting or taxonomy coding to contact them for advice on coding issues.

An internal UKHSA review found that the most frequently amended primary pathway subcode was ‘on-set imaging: compliance with local image guidance protocols’, often revised to ‘on-set imaging: production process’, reflecting ongoing challenge in selecting the appropriate coding when imaging-related events occur.

RTE reports and attendance data

Estimated UK radiotherapy activity reached, after extrapolation, 4,052,482 attendances and 434,773 prescriptions (14), with increases of 4.9% and 7.2% respectively from the previous 2-year reporting period. Figure 34 compares this activity with monthly RTE submissions. Attendance and prescription data were extracted from CancerData on 12 March 2026.

Figure 34. Number of RTE reports submitted to the national voluntary reporting system by classification per month and attendance data



Assuming most RTEs relate to a single attendance, the estimated reporting rate was 6.4 per 1,000 attendances, up from 5.7 per 1,000 attendances during the previous 2-year reporting period. These RTEs are largely compromised of minor or no-harm events. The estimated Level 1 events rate rose to 1.3 per 1,000 prescriptions (up from 0.9), though reporting delays may affect interpretation.

Provider reporting levels

The average number of RTEs reported by providers rose from 363 to 438. Though most providers (62.3%) reported below this average, suggesting variations in reporting culture across, and within, providers (20). Differences may also reflect provider size and activity levels, the transition to LFPSE platforms affecting reporting capacity, and workforce pressures impacting staff reporting (21, 22).

Compared to NHS England data, radiotherapy reports show fewer ‘no harm’ events and more low-harm events (23), indicating providers may be underreporting lower-level radiotherapy

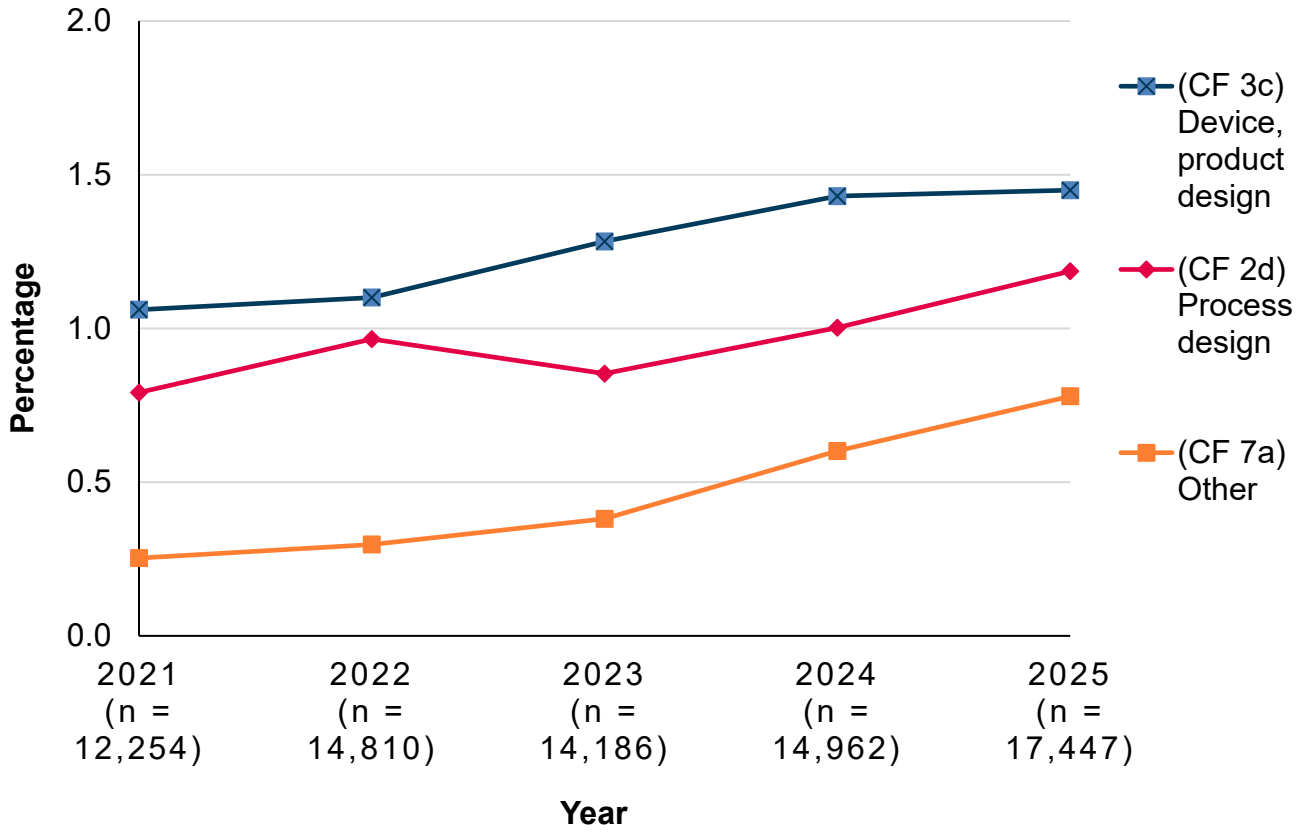
events. Survey data ('Safer Radiotherapy' Sept 2024) supports this, showing that while all providers report Level 1 RTE events, fewer than half report all levels of RTE.

Contributory factors

'Equipment or IT network failure' has increased by 65.0% over the 5-year period (10.3% in 2021 to 17.0% in 2025). In contrast, the most frequently reported contributory factors have declined. 'Slips and lapses' fell by 14.4% (31.2% to 26.7%), and 'adherence to procedures, protocols' by 25.8% (26.4% to 19.6%). Together with relatively stable 'communication', these account for 77.3% of all contributory factors.

Less common contributory factors have shown significant increases (Figure 35). These include 'device, product design' (1.1% to 1.4%, p=0.01) and of 'other' (0.3% to 0.8%, p=0.01) possibly reflecting greater recognition of systemic design issues and system complexity. However, 'other' is non-specific and should be used cautiously, with clear supporting detail in event descriptions.

Figure 35. Trends for selected reported contributory factors (January 2021 to December 2025)



When coding RTE reports, providers should consider all possible contributory factors to support a systems-based approach, focusing on underlying and latent issues rather than only immediate causes. More information can be found in Advancing Safer Radiotherapy.

Although earlier reports suggested a shift toward system-level factors such as ‘inadequate training’, ‘inadequate procedure, protocols’ and ‘inadequate leadership’, these have not shown significant increases over this 5-year period.

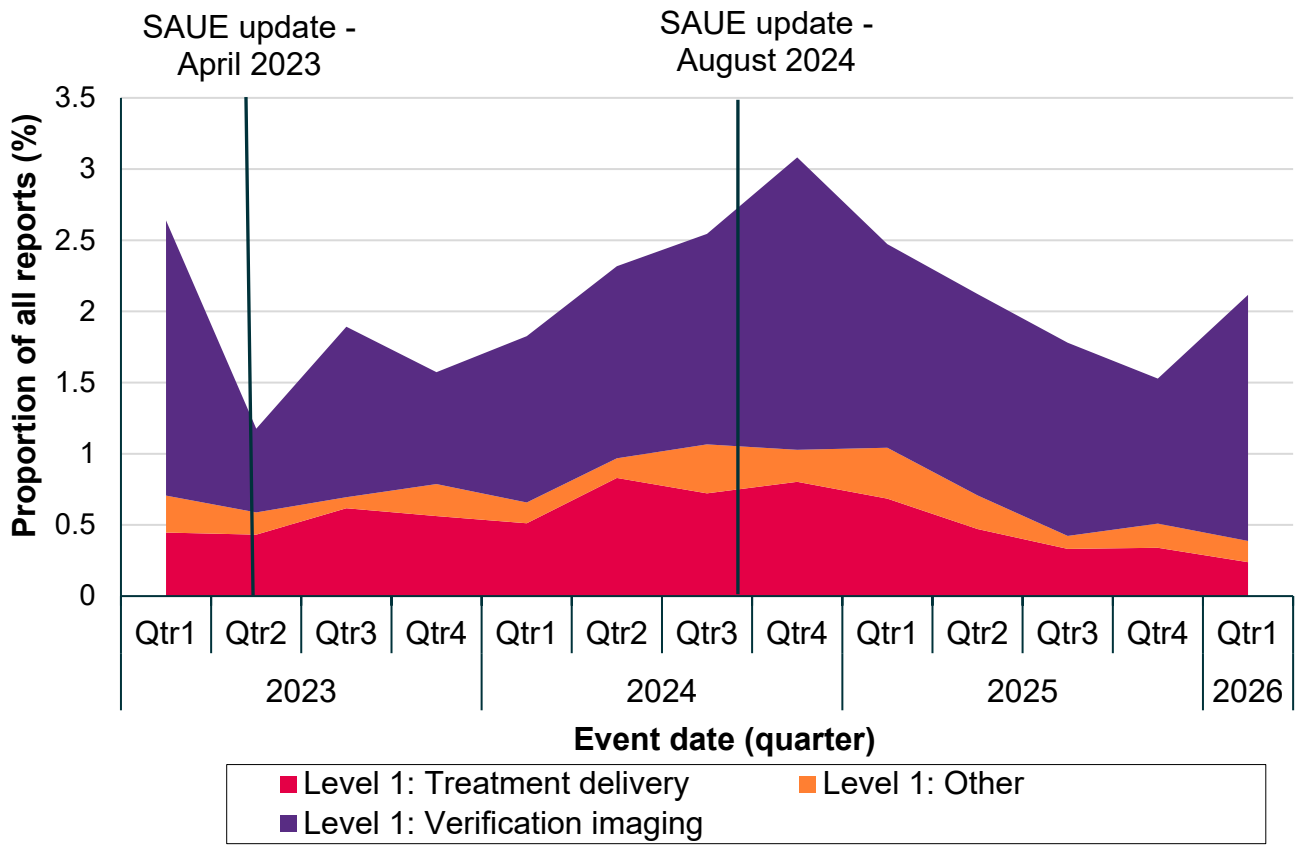
Level 1 data

The proportion of voluntary Level 1 RTE increased from 1.6% to 2.3%, largely driven by events involving repeat verification imaging (62.2%). The most common pathway subcodes - ‘on-set imaging: production process’ and ‘management of variations, unexpected events’ - were mainly linked to ‘equipment or IT network failure’, aligning with inspectorate findings of rising equipment-related issues.

Figure 36 shows a decrease in the proportion of Level 1 events in early 2023, followed by a rise to a peak in Q4, 2024. The subsequent decline is likely influenced by updated SAUE guidance published in August 2024 (changes to the Multiple exposures category). This suggests that Level 1 incidents are mainly influenced by verification imaging events.

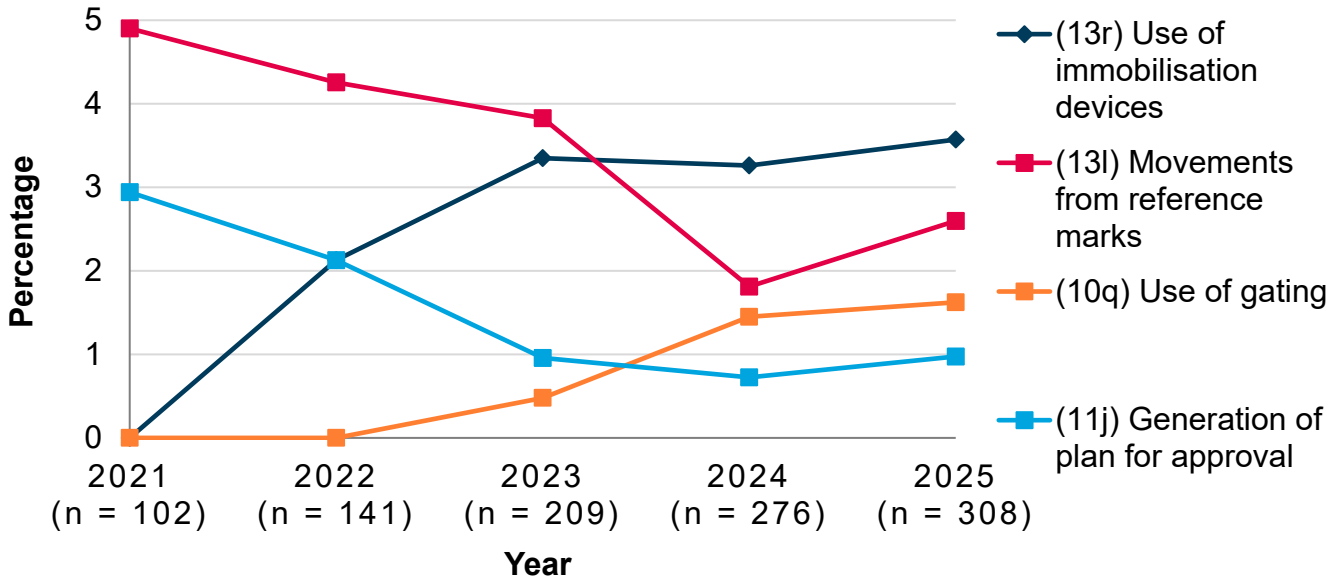
Although such imaging incident are disruptive, they involve significantly lower doses than treatment delivery. Level 1 RTE associated with treatment delivery (red area) have declined from a peak of 0.8% in Q2 2024 to 0.3% in Q4 of 2025.

Figure 36. Level 1 events, including those reaching the point of treatment delivery, as a proportion of all voluntary RTE received quarter 1 2023 to quarter 4 2025



While treatment verification events dominate, emerging Level 1 trends warrant attention. 'Authorisation of exposure' increased from 1.0% in 2021 to 5.8% in 2025 (Figure 7), likely linked to verification imaging exceeding protocol limits without prior justification. Further information can be found in the Safer Radiotherapy Triannual RTE report, issue 45.
Figure 37 demonstrates statistically significant emergent trends, including a rise in pretreatment imaging involving 'use of gating' (p=0.01). Whilst total numbers remain small (n=10 in 2025), this may reflect increasing use of techniques such as DIBH. Other emergent trends include a growth in events related to 'use of immobilisation devices'. Again, total numbers remain small (n=30 in 2025). These events are usually detected through verification imaging, rarely impacting treatment delivery, but often become reportable due to repeat imaging.

Figure 37. Selected trends for level 1 RTE by process subcode (January 2021 to December 2025)



Level 2 data

Level 2 incidents remain low at 0.7% (n=193), down from 0.9% (n=194) from the previous reporting period, limiting meaningful analysis and learning. Refinement of the definition of Level 2 RTE may improve granularity and help better identify potentially significant imaging and treatment incident that fall below current reporting thresholds.

Level 3 data

Radiotherapy depends on complex systems that perform with remarkable reliability but can occasionally suffer from system malfunction and failure. Equipment malfunction is most often reported in treatment areas and prominent in Level 3 reports. 'On-set imaging: production process' remains a major contributor (31.5%), with increasing attribution to equipment or IT

failure (62.7%). Significant growth is also seen in ‘management of variations, unexpected events’, again largely driven by equipment issues (89.2%).

Overall, equipment and IT failures account for a substantial proportion Level 3 reports, and total RTE reports. Guidance emphasises reporting all device-related events:

- Safer Radiotherapy E-bulletin number 16 – Medicines & Healthcare products Regulatory Agency (MHRA) good practice piece explaining every adverse incident involving a medical device, including those associated with aging equipment, or general wear and tear of equipment should be reported to the relevant equipment regulator
- Safer Radiotherapy E-bulletin number 17 - good practice piece from the Scottish IR(ME)R regulator, Healthcare Improvement Scotland (HIS), emphasising the importance of reporting and sharing learning from events involving equipment malfunctions, on a local and national level, to improve the safety and quality of care delivered to patients
- Safer Radiotherapy Triannual RTE analysis and learning report number 47 – a summary of equipment failure related data over a 16-month period, including recommendations to mitigate these types of events

When these events persist, it should be expected that:

- logged events are documented and monitored to identify causal factors and trends so that action and escalation of these events can be taken as appropriate
- the manufacturer, the relevant agency (Medicines and Healthcare products Regulatory Agency, and the Incident Reporting and Investigation Centre (IRIC), for Scotland) and, where appropriate, the IR(ME)R inspectorates (8, 9) are notified of the occurrence of these events
- providers are encouraged to investigate methods for predicting equipment failure and allow for proactive maintenance to limit the impact of unscheduled repairs (24 to 26)
- providers perform risk assessments for the affected equipment, identifying appropriate thresholds for when consideration is given to removing the device from clinical use

Safety barriers

The newly updated Safety Barrier taxonomy (appendix 1) has been adopted to provide greater specificity in the identification of effective and ineffective safety barriers throughout the patient pathway.

The most frequently cited ineffective safety barrier was ‘on-set imaging: approval process’ (12.2%, n=1,122). Overall, end of process checks across the radiotherapy pathway accounted for 41.2% of all ineffective safety barriers identified. Many of the commonly reported ineffective safety barriers are designed primarily to detect problems after they have occurred rather than prevent them from arising. These controls often rely on human-dependent detection mechanisms to identify errors late in the treatment pathway. While such checks remain an

essential component of safe radiotherapy practice, their prominence within the dataset highlights potential limitations associated with independence, vulnerability to cognitive bias, and the need for stronger preventive controls earlier in the workflow.

Analysis of ineffective safety barriers provides an opportunity to identify areas where system and process safety controls may benefit from further strengthening. However, interpretation of these findings should be undertaken with caution, as data available during the transition to the updated taxonomy remain limited.

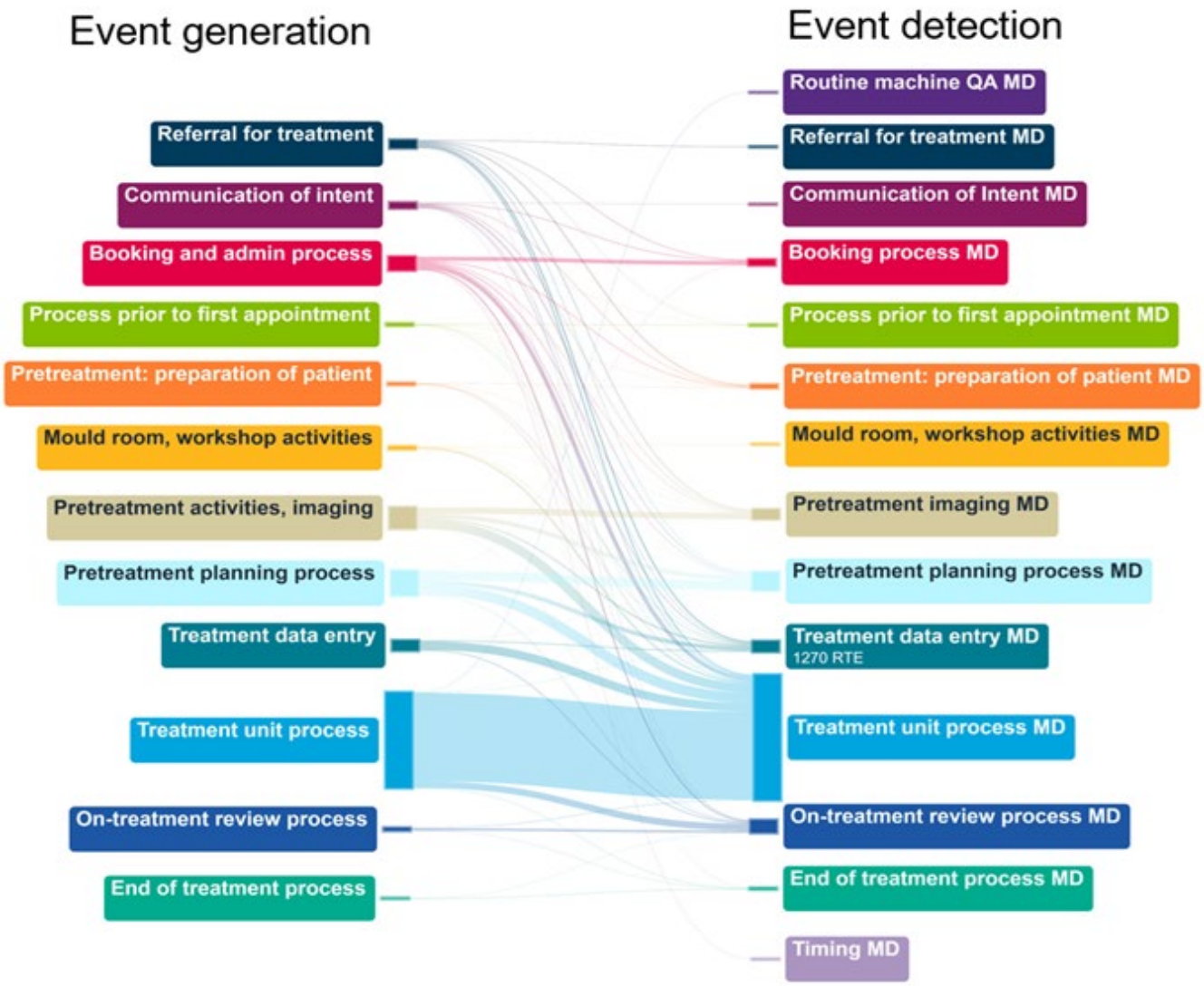
Despite being the most frequently cited ineffective safety barrier, ‘on-set imaging: approval process’ remains the most effective error-detection barrier within the treatment pathway. End of process checks and structured on-treatment reviews also continue to play a critical role in detecting and mitigating errors.

The concentration of error detection at the image verification stage suggests an opportunity to strengthen upstream processes and implement preventive controls earlier in the pathway, thereby reducing the reliance on downstream detection barriers.

Methods of detection

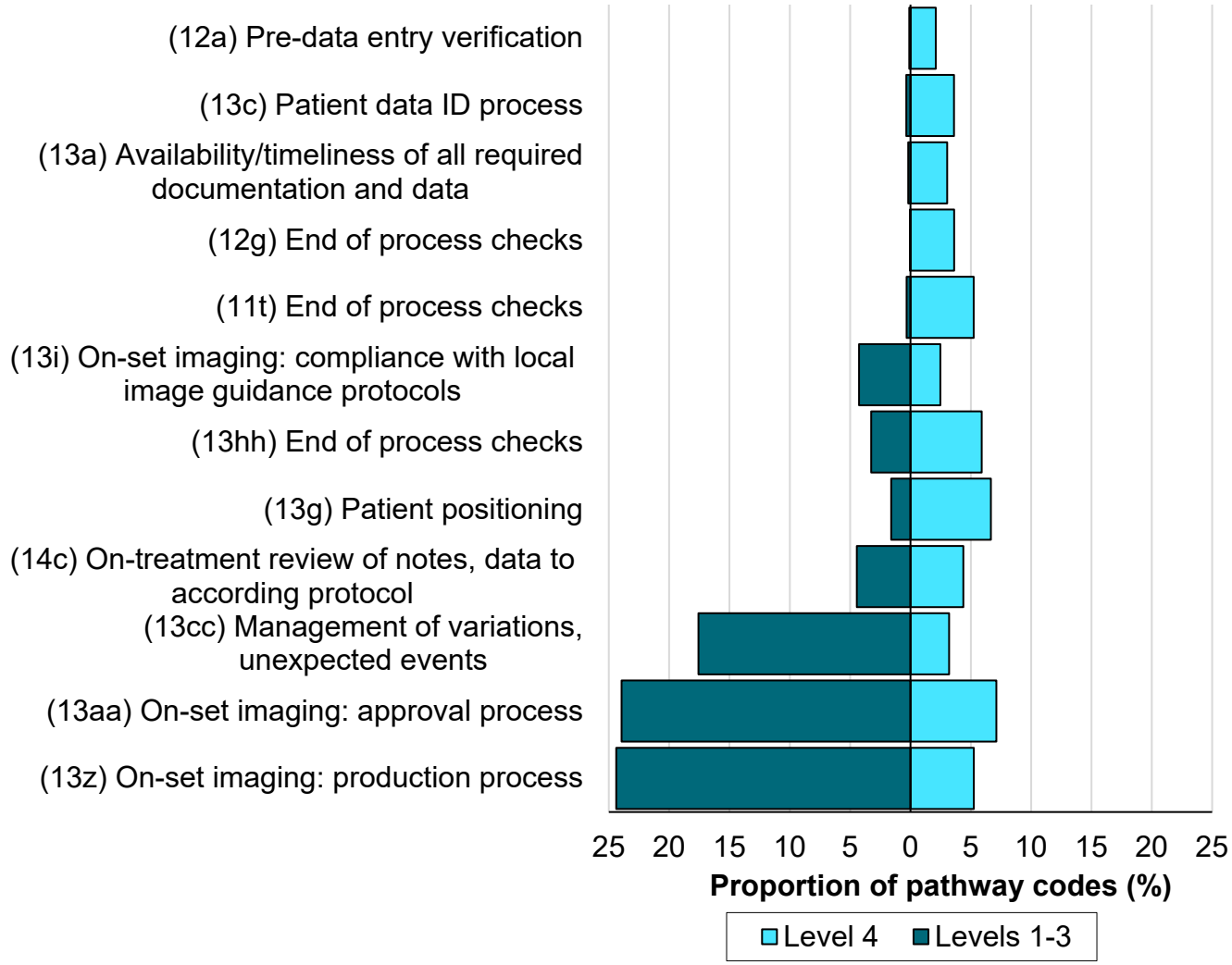
Often events generated in one part of the pathway traverse through several areas before detection. The diagram in Figure 38 below, based on connections between areas with greater than 25 RTE during this reporting period, shows the treatment pathway, associated activities, and the volume of RTE generated, traversing, and detected within each area.

Figure 38. Sankey diagram demonstrating the volume of RTE generated, traversing, and detected along the treatment pathway



Methods of detection differs between those detecting radiation incidents and those preventing them (good catches). Figure 39 shows incident detection (Level 1 to 3) is mainly driven by treatment area subcodes - ‘on-set imaging: production process’, on-set imaging: approval process’ and ‘management of variations, unexpected events’. In contrast, good catch (Level 4) detection is more distributed across the pathway, with ‘patient positioning’ and various ‘end of process checks’ playing key roles in preventing events reaching treatment delivery.

Figure 39. Comparison of most frequently reported method of detection subcodes in Level 1 to 3 and Level 4 data sets



Risk assessment and study of risk

Learning from RTE should occur at local, regional, national, and international levels, with findings used to inform prospective risk assessments in key thematic areas (27).

A study of risk helps providers identify and evaluate potential risks, including their likelihood, potential impact, and effectiveness of controls, balancing these against benefits and costs (16). Using recognised, regularly reviewed risk assessment methods supports this process with further guidance available. Table 4 highlights the most frequently reported pathway subcodes and where the associated example study of risk for these pathway subcodes can be found.

Supplementary UKHSA learning resources are available, including a number of presentations available to stream on the UKHSA website, aimed at supporting professionals in the RT community. In addition, Advancing Safer Radiotherapy focuses on learning retrospectively from RTE through incident analysis and use of RTE data to inform simple prospective risk assessments.

Table 4. Most frequently reported process subcodes and associated study of risk

Most frequently reported process subcode	Study of risk available in associated Safer Radiotherapy publication:
(13z) On-set imaging: production process	Triannual RTE analysis and learning report issue 32
(13cc) Management of variations, unexpected events	Triannual RTE analysis and learning report issue 50
(12f) Accuracy of data entry	Triannual RTE analysis and learning report issue 36
(10j) Documentation of instructions/information	Triannual RTE analysis and learning report issue 33
(13aa) On-set imaging: approval process	E-bulletin number 5
(13g) Patient positioning	Triannual RTE analysis and learning report issue 39
(13i) Use of on-set imaging	E-bulletin number 5
(11j) Generation of plan for approval	Triannual RTE analysis and learning report issue 38
(6a) Bookings made according to protocol	To be completed
(11i) Target and organ at risk delineation	Triannual RTE analysis and learning report issue 43

Conclusion

Despite its complexity, radiotherapy remains a safe practice, supported by a strong safety culture and widespread participation in national event learning. All NHS providers have contributed RTE reports, enabling shared learning from incidents and benchmarking to reduce risk.

RTE reporting has increased by 16.8%, partly due to higher activity but also likely reflecting improved reporting practices. While level 1 event rates have risen, a reduction in those linked with therapeutic delivery suggests tangible safety improvements.

The general increase in RTE volumes may not simply be ascribed to improved reporting practices. Increasing workload and reported staffing issues (28) may contribute to fatigue and burnout, increasing the likelihood of preventable events (29). Overall, national radiotherapy event reporting in the UK is well established and provides a valuable resource for identifying trends at national level and proactively improving patient safety.

Recommendations

Local provider recommendations

1. All NHS UK providers should continue to use the national taxonomies, adopting the refinements found within the recently published Safer radiotherapy National patient safety radiotherapy event taxonomy, to fully code all levels of RTE for local analysis, learning and practice.
2. The wider context of the system should be considered when reviewing RTE to ensure all contributory factors are identified and appropriately addressed.
3. Local employers should provide adequate resourcing to support the development and maintenance of effective patient safety systems and processes. Likewise, they should encourage national reporting of all classification Levels of RTE on a monthly basis to ensure timeliness of shared learning.
4. Equipment-related incidents should be reported to the relevant regulator, manufacturer and UKHSA. If equipment faults persist a risk assessment should be undertaken for the ongoing use of the device.
5. Local and regional radiotherapy event learning should be benchmarked against national data to identify trends and opportunities for improvement. Findings from event analysis should be used to inform prospective risk assessments, support the evaluation of risks associated with accidental and unintended exposures, and guide service development, quality improvement initiatives, education and training programmes, and business planning (30).

National recommendations

1. Learning from RTE should be used by the Patient Safety in Radiotherapy Steering Group (PSRT) and individual RT providers as part of a risk-based approach to allocating resources for improving patient safety in RT and to inform audit and research.
2. PSRT should engage the relevant agencies and vendors in developments to monitor and reduce the rate of RTE related to imaging equipment failure.
3. Providers utilising molecular radiotherapy (MRT) or diagnostic MRI facilities are encouraged to use the National taxonomy for incident learning in clinical imaging, magnetic resonance imaging and nuclear medicine guidance and reported within the National incident learning system in clinical imaging, MRI and nuclear medicine.
4. Working with stakeholders the PSRT will continue to develop guidance for UK RT providers to support the advancement of safer RT through the adoption of contemporary thinking in the field.
5. The PSRT should continue to develop its analysis of the newly refined Safety Barriers taxonomy, using insights gained to inform improvement initiatives and strengthen safety practice.

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Appendix 1. Safety barriers

Pathway subcode
(2j) Installation and testing before clinical use (amalgamated previous codes 2b, 2c, 2d)
(3m) Daily consistency checks (amalgamated previous codes 3a, 3b, 3c)
(3n) Planned QA programme checks (amalgamated previous codes 3e, 3f, 3g,3h)
(4a) Identification of patient (verification against primary source data)
(4b) Verification of diagnosis, extent, stage (including laterality)
(6g) Use of electronic task lists (quality check list, care pathway)
(8a) Confirmation of ID
(8b) Confirmation of consent
(8c) Confirmation of fertility, pregnancy status
(8d) Advice on procedure (including training on breath hold, bladder or bowel preparation, CIED or electronic device status, information on pre-medication, fiducial insertion, MRI safety and so on)
(9a) Confirmation of ID
(9d) Checking, fitting of immobilisation devices
(9g) Labelling of mould room, workshop outputs
(9i) Instructions to patient
(9k) End of process checks
(10a) Confirmation of ID
(10o) Assessment of patient prior to exposure
(10r) Monitoring of patient during pretreatment activity exposure
(10s) Assessment of patient after exposure (including RF burns for MRI)
(10u) In-room end of process checks
(10v) Pre exposure end of process checks
(10w) Completion of pretreatment exposure end of process checks
(11a) Verification of patient ID, orientation and data entry format to include all patient data, imaging and so on
(11i) Target and organ at risk delineation (including incorrect growing of volume and auto contouring)
(11l) Verification of plan, identification of responsible staff (including patient specific quality control checks)
(11s) Calculation checking process for non-planned treatments
(11t) End of process checks

Pathway subcode
(12a) Pre-data entry verification (including OMS data import)
(12d) Correct ID of patient, all patient input data
(12e) Correct ID of patient output data
(12g) End of process checks (including OMS data import)
(13b) Patient ID process
(13c) Patient data ID process
(13d) Explanation, instructions to patient
(13e) Confirmation of pregnancy, fertility status
(13f) Assessment of patient prior to treatment (including pre-medication prior to treatment, for example, analgesia, antiemetics and so on, cardiac implanted electronic device (CIED) status, MRI safety)
(13h) Use of IVD according to local protocol
(13aa) On-set imaging: approval process (including image review not completed, image review inaccurate, image matched to wrong reference image, incorrect prioritisation of structures for matching)
(13kk) Monitoring of patient during treatment exposure
(13mm) In-room end of process checks
(13nn) Pre exposure end of process checks
(13oo) Completion of treatment exposure end of process checks
(14a) On-treatment review of patient according to protocol by RT staff
(14b) On-treatment review of patient according to protocol by other professional
(14c) On-treatment review of notes, data according to protocol (including omission of weekly chart checks)
(15i) Maintenance of position of applicators, sources (including movement of applicators, seed migration)
(15l) Validation of applicator, source position
(15q) Imaging: approval process (including incorrect image acceptance)
(15s) End of process check (at each element of the workflow such as pause and check)
(15t) Patient ID Process
(15u) Patient data ID process
(15v) Assessment of patient prior to treatment (including pre-medication, anaesthetic, for example anticoagulation, analgesia, antiemetics and so on, cardiac implanted electronic device (CIED) status)
(15w) Monitoring and assessment of patient during treatment

Pathway subcode
(16a) Communication of appropriate end of treatment information to patient
(17a) Follow-up consultation process and documentation (including follow – up actions required, patient identified unexpected toxicity or potential adverse event)
(19b) Audit (including new and established processes)

Acknowledgements and PSRT Steering Group membership

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- Inspectorates for IR(ME)R across the UK
    - Care Quality Commission (CQC) in England
    - Healthcare Improvement Scotland (HIS) in Scotland
    - Healthcare Inspectorate Wales (HIW) in Wales
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PSRT steering group membership

- Dr Sarah Allford (Lay Representative from 2024)
- Helen Best (UKHSA)
- Neil Burley (Society of Radiographer's Clinical Representative – Radiotherapy Quality Manager, University College London from 2024)
- Peter Dickinson (Royal College of Radiologists – Consultant Clinical Oncologist, Leeds Teaching Hospitals NHS Trust from 2024)
- Martin Duxbury (Society of Radiographer's Clinical Representative – Deputy Head of Radiotherapy, St James Institute of Oncology, Leeds until 2024)
- Úna Findlay (UKHSA and Group Chair)
- Spencer Goodman (Society of Radiographers – Professional Officer)
- Petra Jankowska (Royal College of Radiologists – Consultant Clinical Oncologist, Taunton and Somerset Foundation Trust and Medical Director at RCR until 2024)
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- Kim Stonell (UKHSA and PSRT secretariat)

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